THE UNIVERSITY OF ALBERTA

ESTIMATION OF EXTRA-MARKET BENEFITS ASSOCIATED WITH THE RECREATIONAL USE OF THE CLEARWATER-ROCKY FOREST IN ALBERTA

by

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ABSTRACT

Although recreation is a growing use of natural resources which often comes into increasing conflict with other uses, there is no set of explicit market prices to determine the value of recreational use and, hence, to compare such use with alternative uses. Consequently, it is typically difficult to apply conventional economic criteria in the allocation of natural resources among recreational and various non-recreational uses. This thesis is an empirical application of the Hotelling-Clawson technique in valuing the non-priced recreational services of a forest on the Eastern Slopes of the Rocky Mountains in Alberta.

The Hotelling-Clawson technique involves the indirect estimation of the demand for recreational use of a natural resource or area and results in an estimation of users' willingness to pay for such use. Alternatively, a measure of value of recreational use is estimated as if the market were operational for the area under consideration.

A slightly modified form of the Hotelling-Clawson technique was applied to data generated in the Clearwater-Rocky Forest in 1972. By use of the technique, the demand for the entire recreational experience and the demand for the recreational services of the Clearwater- Rocky Forest itself were estimated. The extra-

market benefits associated with recreational use of the Clearwater-Rocky Forest were calculated in terms of the area under the latter second stage demand curve. The estimated value of the Clearwater-Rocky Forest in recreational use, for the summer months of 1972, was calculated to be approximately one million dollars. On a visitor-day basis, for the same time period, the recreational value of this area of the Alberta forest resource was estimated to be $3.46 to non-vacation users and $4.79 to users who were on annual vacation.

Due to limitations inherent in the data base, the Hotelling-Clawson technique, and the assumptions necessary throughout the application of the technique, the resulting estimates of value may be taken only as an approximation, possibly a rather crude approximation, of the value of the Clearwater-Rocky Forest in recreational use.

Nonetheless, this application of the Hotelling-Clawson technique has indicated a "reasonable" value for recreational use. This "reasonable" value so estimated may be useful in formulating general guides to the value of recreational use of forested land and to the allocation of this resource in Alberta.

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CHAPTER I

Introduction

Purpose of the Study

This study is an attempt to estimate the extra-market benefits associated with the recreational use of the Clearwater-Rocky Forest. Using the Hotelling-Clawson technique to estimate the demand for this recreational facility, and the consumers' surplus approach to the estimation of benefits, a value in recreational use is placed on this part of the Alberta forest resource. The purpose of the study is to indicate that, with a relevant and reliable data base, the monetary value of a resource in recreational use may be approximated. Such an estimation of the monetary value of a resource in recreational use, leads to a common framework within which various uses may be compared in the process of efficient allocation of that resource.

Recreational Use of Natural Resources

Participation in outdoor recreation activities has undergone observable increases in recent years. This trend may be expected to continue in the future as leisure time, disposable income and urbanization also undergo positive changes. As is often the case, recreational use of a natural resource may conflict with other potential uses. This is true of the forest resource in

Alberta, where the consumptive use of timber and the necessary modifications to the landscape in the primary industrial process of wood production may be detrimental to the participation in, and enjoyment of, recreational experiences.[1] Should a conflict among uses arise, the optimal allocation of resources to various uses requires the estimation of the social benefits and costs associated with each use. Only when all such benefits and costs are measured, and therefore comparable, will the allocative decision be that which maximizes net benefits to society as a whole. This study is concerned with that portion of the benefits derivable from the recreational use of the forest resource which are not directly measurable, and are consequently often overlooked in decisions concerning the allocation of forest resources to various uses. It is a case study of the potential for more comprehensive measurement of the primary benefits derivable from the recreational use of a natural resource.

The Study Area

The study area is the Clearwater-Rocky Forest located in west-central Alberta. The position of the area relative to the rest of the province is indicated in Figure I-1. The primary reason for the choice of the area was that a fairly comprehensive data base on recreational use had been generated in the recent

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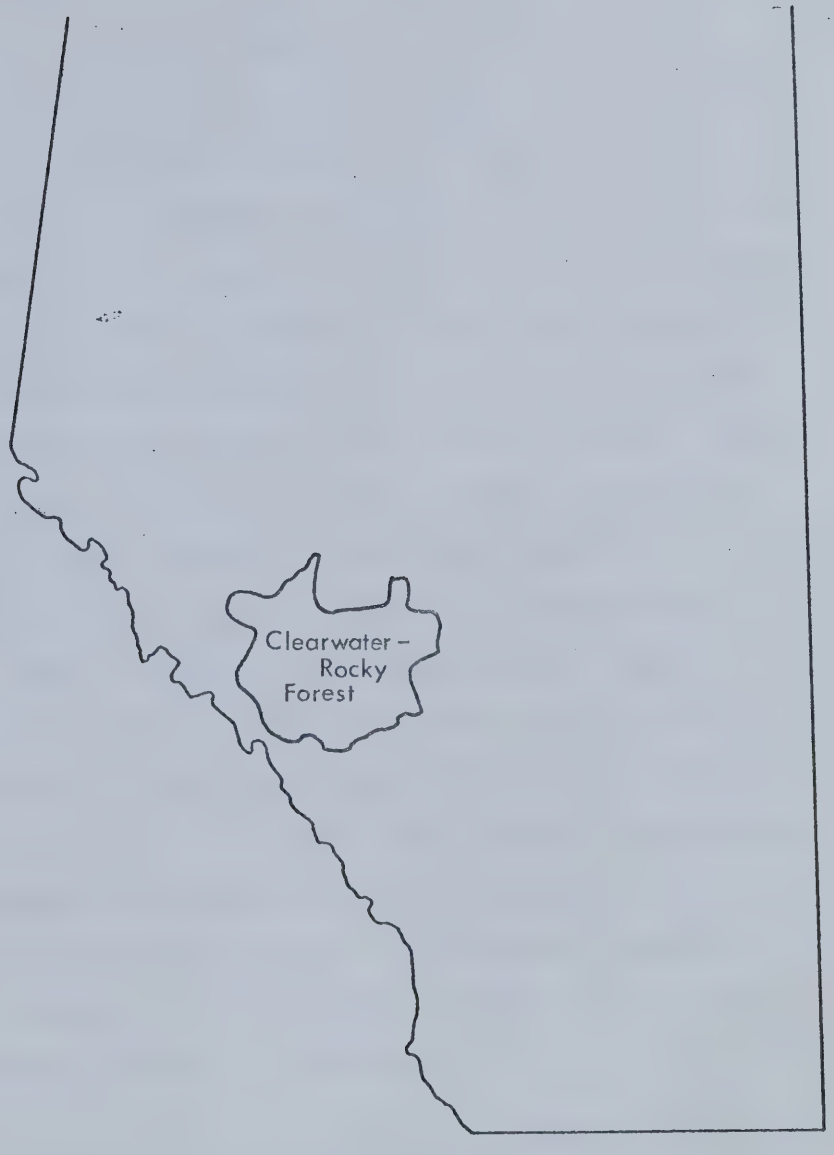
[1] There are exceptions to this case whereby the process of wood production enhances various facets of the recreation experience.

Figure 1-1

LOCATION of CLEARWATER-ROCKY FOREST



SOURCE: E.P.E.C. Consulting Ltd. and C.L. Sibbald Agri-Business Ltd.
The Forest Resource in Alberta--An Examination with
Respect to Conservation, Recreation and the Forest Industry
p.b.

past. The Forest Land Use Branch of the Alberta Department of Lands and Forests (now Energy and Natural Resources) completed a user survey in the area in 1972.

Scope of the Study

The Clearwater-Rocky Forest offers a diversity of activities to the prospective recreationist. A more comprehensive listing of these may be found in the pamphlet on the Clearwater-Rocky user survey.[1] This study is an examination of the general amenities supplied within the Clearwater-Rocky Forest of Alberta; it is not an attempt to evaluate the demand for, nor the benefits derivable from, participation in any specific activity. The results should not be imputed to the evaluation of the benefits associated with, for example, water-based recreational activity. On the other hand, further study may indicate that there is, in fact, a close relationship between the demand for forest resource-based activities and the demand for purely water-based activities. In addition, the resulting analyses may also be taken to apply only to that forest for which they are estimated. The demand for recreational experiences generated by a forest area other than the Clearwater-Rocky would have to be considered separately.

Recreational activity within a forest area also tends to be dispersed as opposed to highly intensive. Again, the derived

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[1] Forest Land Use Branch, Alberta Lands and Forests, "1972 Clearwater-Rocky Forest User Survey", (Edmonton, 1974).

demand curve for highly intensive recreational opportunities may diverge from the relationships observed here; or alternatively it may not. In summation then, only further study will indicate the degree of comparability among activities, areas and types of outdoor recreation. The results of this study may not be taken to apply to any other situation beyond the confines of the data base examined.

Background to the Study

This study was completed partially in response to the recommendations which came from the public hearings on the Eastern Slopes held by the Environment Conservation Authority, Alberta, in 1974.[1] Throughout the recommendations there is expressed a need to allocate the forest resource in Alberta in a way which will take into account all demands placed upon the resource. Zoning of areas within the forest lands and the Eastern Slopes requires that a full inventory of all uses -- present and future -- be taken. Efficient allocation of the resource also requires that the value of the forest in all uses be fully quantified. Such values should be estimated as accurately as possible and then compared over time. The benefits to be derived from the forest resource, in many cases, are readily quantifiable. This is not so, however,

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[1] Alberta, Environment Conservation Authority, Land Use and Resource Development in the Eastern Slopes: Report and Recommendations, a report on the Public Hearings into Land Use and Resource Development in the Eastern Slopes, as required by Section 7(1)(e) of The Environment Conservation Act, Edmonton, 1974.

in the case of the recreational use of the forest resource. It is to this problem that the study is addressed.

Economics and Recreation

The provision of outdoor recreation, partly due to its intrinsic characteristics and partly due to institutional and historical reasons, has public good characteristics. Apart from the individual's cost of access to the particular facility, there is no charge for use; or where there is an entrance fee, it is of a nominal amount. This public good nature of recreation eliminates the operation of the conventional market system where a price-quantity relationship, or a demand curve, may be established by observing the behaviour of purchasers. In other words, there is no market in which the recreationist may indicate, by his purchasing behaviour, the value he places on any recreational facility. The absence of a demand curve also eliminates the possibility of further analysis, such as the estimation of benefits to be derived by the recreational users of the resource. The difficulty of measurement associated with such benefits, and their all too often subsequent exclusion, renders many comparisons of net benefits from forest lands over time and across uses meaningless. To yield a true picture of the total net benefits to be derived, all benefits -- including the extra-market benefits associated with the recreational use of forest lands -- should be considered in the evaluation.

Research Objectives

This study will attempt to indicate the potential for such analysis. The first section presents an introduction to the problem by examining, in an economic framework, three reports completed on the forest resource in Alberta. Having looked at the progress made in evaluating the so-called environmental intangibles associated with the forest resource in Alberta, an overview of the state of the art of estimating the demand for outdoor recreation will be made. One of these techniques is then applied to the data generated by the 1972 user survey in the Clearwater-Rocky Forest. Using the resulting estimate of the demand for the Clearwater-Rocky Forest, the value of this part of the Alberta forest resource in recreational use is calculated. Suggestions for further research associated with benefit estimation with respect to recreational resources and for data collection to improve the reliability of techniques available are presented as a conclusion to the study.

CHAPTER II

Economic Assessment of Three Reports on the Forest Resource in Alberta

Economic Considerations in the Reports

In any study concerning the use of natural resources, and in this case the forest resource, certain concepts and considerations are necessary inclusions in the analytical framework. This section of the study comprises the first part of a review of the literature dealing with the recreational use of natural resources, and presents such necessary economic concepts and considerations. An examination of the attention and interpretation afforded them in each of three reports completed, dealing with the forest resource in Alberta, will be undertaken.

An evaluation of the methods derived for the estimation of recreational demand, applicable to the recreational use of the forest resource, will form Chapter III of the study, thus completing the literature review section of the study.

Background of the Reports

Three reports on the forest resource in Alberta were prepared as background material for the public hearings on the Eastern Slopes.

One of these, completed under the auspices of the

Environment Conservation Authority by E.P.E.C. Consulting, took as its terms of reference, "an examination of the impact of the forest industry on the environment and recreation."[1] These terms of reference were subsequently expanded to include economic and management aspects of the forest industry. The study unit is the forested area of Alberta in general.

Another report by C. D. Schultz and Company was prepared at the joint request of the Alberta Ministers of Lands and Forests and the Environment. This report states its scope as follows:

> Primary land use is expanding forest industries while maintaining a quality environment for water yield and wildlife habitat, new industrial and municipal development, traditional forms of livelihood and appropriate outdoor recreation opportunities . . .
>
> The purpose of this project is to determine how forest management practices can best contribute to achievement of these combined objectives.[2]

The study unit in this report is limited to the Edson and Grande Prairie Forests, and a portion of the Whitecourt Forest.

The third report, prepared by W.R. Hanson, was presented to the public in advance of the proposed public hearings on forest

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[1] E.P.E.C. Consulting Ltd. and C.L. Sibbald Agri-Business Ltd., The Forest Resource in Alberta: An Examination with Respect to Conservation, Recreation and the Forest Industry, (Edmonton, 1972), p. ii.

[2] C.D. Schultz and Company, The Environmental Effects of Timber Harvesting Operations in the Edson and Grande Prairie Forests of Alberta, (Vancouver, 1973).

utilization and its environmental effects in Alberta. This report states its purpose as follows:

> . . . to compile pertinent information on the growing, harvesting, and processing of wood and wood products in Alberta, as well as to assess the impact of these activities upon the environment.[1]

Again the study unit is the forested area of Alberta in general.

Alternate Uses of the Forest Resource

Each of the three reports is concerned with the alternate uses of the forest resource in the province of Alberta. Among the alternate uses included are the following:

(1) the cutting of timber for the manufacture of wood products;

(2) the use of the forest resource as an aesthetic and spatial input into the recreational experience;

(3) depletion of the forest resource by industries other than forestry -- this includes such operations as seismic explorations, power lines, pipelines, oil and gas wells, coal explorations and mining;

(4) the habitation of forested areas by wildlife;

(5) flow regulation and anti-erosion in the surrounding area.

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[1] W.R. Hanson, Forest Utilization and Its Environmental Effects in Alberta, (Calgary, 1974).

The use under primary consideration in this study is that of the forest as an aesthetic and spatial input into the recreational experience. For purposes of illustration major reference will also be made to the alternative use -- the cutting of timber for the manufacture of wood products. The other potential uses of the forest resource should be borne in mind, despite the fact that a detailed analysis of them will not be included here.

The Forest as a Flow Resource

The forest may be technically defined as a flow resource since it is renewable.[1] The flow nature of the resource is recognized by Hanson as follows:

> The environmental factors which resulted in the natural growth of forest on an area of land will, if unchanged, again promote regeneration of the same type of forest, following fire or logging.[2]

Human intervention through reforestation tends to speed up the renovation process. The resource is also characterized by a critical zone in quantitative and qualitative terms.[3] Overuse or misuse of the forest may lead to a situation of irreparable damage to the extent that the resource will not regenerate to its former standards

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[1] See S.V. Ciriacy-Wantrup, Resource Conservation: Economics and Policies (3rd ed.; Berkely: University of California Agricultural Experiment Station, 1968), pp. 38-43 for a fuller explanation of this.

[2] Hanson, Forest Utilization and Its Environmental Effects in Alberta, p. 30.

[3] Ciriacy-Wantrup, Resource Conservation, pp. 38-40.

of quantity and quality.

Sustained Yield Management

Sustained yield, a forest management practice, ensures that the resource is not depleted beyond quantitative regeneration. Timber operators are required to practice reforestation, or to pay a reforestation fee. Such reforestation practices insure a continuous supply of timber for harvestation now and in the future. However, as Hanson points out:

> In the vast areas of central and northern Alberta, government policy is aimed at the sustained yield of wood, with recreation and other uses receiving secondary attention. Due to the remoteness of much of the area it may be difficult to argue against such a policy, although some may not agree with the amount of attention given to recreation, wildlife and watersheds, nor to the specific ways in which the policy is being implemented.[1]

Again, overuse or misuse of the forest resource may lead to a situation of irreparable damage to the extent that the forest will not regenerate to its former standards of quantity or quality. Inferior standards may render the forest incapable of sustaining wildlife use or an enjoyable recreational experience.

Conflicts in Use

Once more, for purposes of illustration, the forest will be considered as a natural resource input into two commodities --

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[1] Hanson, Forest Utilization and Its Environmental Effects In Alberta, p. 17.

recreation and wood products. In this case there is a superficial conflict of resource use. "Production" of an enjoyable recreational experience requires that the major input be aesthetically pleasing and spatially available. In other words, it is required that the forest resource has not been depleted beyond its critical zone. Modification of the landscape necessary to generate the inputs for the manufacture of wood products may, in fact, place the resource in its critical zone for recreational use. However, not all the activities of the wood products industry are in conflict with the recreational use of the resource. Roads, built in the process of wood production, facilitate access to recreational areas.[1] Hunting opportunities are more readily available when a recently harvested location becomes a browsing area for ungulates.

Multiple Use of the Forest Resource

Conflicting demands placed upon a natural resource do not necessarily rule out one or the other of any two or more uses of that resource. In relation to this illustration, the forest may serve simultaneously as an aesthetic and spatial input into the provision of recreational opportunities, and as a physical input into the wood products industry.

Simultaneous satisfaction of demand is termed multiple use and is based upon the premise that the sum of net benefits over

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[1] Hanson, Forest Utilization and Its Environmental Effects in Alberta, p. 49, gives this example of compatibility in use.

time may be greater if the resource is used to satisfy more than one demand, as opposed to allocation for a single use. User pressures placed upon a resource may be compatible or conflicting.[1] The situations of compatibility or conflict have, however, some further implications. The first consideration relates to the temporal distribution of use rates. From a cursory examination of two potential uses, a conflict may appear to exist. However, a form of multiple use may be feasible on a seasonal basis, where the apparently conflicting uses occur at different times of the year, the net result being a neutral relationship between the two.[2]

Again, two uses may be superficially in conflict, nonetheless, up to a certain level of use, they may be viably co-existent. This consideration relates to the capacity of the resource to sustain various uses. That is, at what level of use does one start to infringe upon the other? Alternatively, although present levels of use may not incur conflicts, or may in fact be complementary in terms of revenues or costs, future levels of use may indeed lead to such conflicts. Both the level of use and the inter-temporal distribution of use rates -- seasonally and over time -- must be considered when determining compatibility or conflict and optimum multiple use policy.

The following quotation indicates the policy of the Alberta

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[1] See S.V. Ciriacy-Wantrup, Resource Conservation, pp. 66-75, for a detailed explanation of this.

[2] Ibid., p. 68.

Forest Service with respect to the multiple use of the forest resource:

> A basic objective of timber management in Alberta is to create forests which may be used for a variety of purposes. Timber harvesting practices and planning are predicated on watershed management along the eastern slopes of the Rocky Mountains, and in other important watersheds.
>
> Similarly the habitat requirements of big game are now being given consideration, along with other factors, in the development of cutting patterns. Particularly scenic areas are left undisturbed, and the aesthetic values of many landscapes is increasingly recognized in planning the removal of timber . . .
>
> In conclusion the objective of timber management in Alberta is to develop healthy, vigorous forests which will serve as a source of clear water, as a scenic and pleasant place for recreation, as a productive and varied wildlife habitat and as a continuing source of timber products.[1]

Implementation of an optimal multiple use policy will, therefore, represent an inter-temporal distribution of use rates leading to the maximization of net benefits to society.

For a given area of forested land, however, the concept of multiple use is difficult to apply when the uses under consideration are highly conflicting, as may be recreation and timber harvestation. Implementation of a multiple use policy in such an area would be hampered by the identification of the level of

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[1] Hanson, Forest Utilization and Its Environmental Effects in Alberta, p. 17.

timber harvestation at which the recreational potential of the area is decreased. The principle of multiple use may be applied only to the forest resource as a whole. For some forms of recreational use individual tracts of forest land cannot serve simultaneously the needs of recreationists and timber production. Two such uses must exist in spatial isolation where separate areas of the forest are dedicated entirely to each. Therefore, while the concept of multiple use is applicable to the forest resource as a whole, the fact remains that only proper implementation of a multiple use policy will generate maximum net benefits.

Each of the three reports (Hanson, E.P.E.C., and Schultz) on the forest resource in Alberta conclude that an optimum mix of uses is necessary for derivation of greatest total net benefits. The following, from Hanson, is an example of the tenor of each on this subject:

> If multiple use principles are to be applied to forest land, each of the uses (recreation, game production, water yield, petroleum, mining and lumbering) may be reduced below its maximum. Over most of the forest land, however, the greatest total good can be attained by a mix of various uses.[1]

Evaluation of Benefits and Costs

In comparing alternative uses of a resource all benefits and costs associated with each use must be quantified to yield a meaningful measurement of net benefits. A full delineation of

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[1] Ibid., p. 64.

benefits and costs is given by Hanson.[1] The following examples are a reflection of those indicated in his report.

Benefits to be derived fall into two categories -- primary and secondary. Primary benefits are those which accrue as a direct result of the project or resource use. In the use of the forest resource for recreation, the primary benefits to the society of Alberta as a whole would be those extra-market benefits derived by the users of the recreational facilities, who are also residents of the province. It should be noted that primary benefits to society are also associated with non-users: non-users gain from the use of the forest as an input into recreation in the form of "option" or "latent demand".[2] Latent demand is reflected in the willingness of an individual to pay for the option or potential opportunity, granted by a given project or resource use, even though he himself may never participate in that use. If carried to extremes, uses which compromise the aesthetic quality of the forest resource may relegate the quality of the recreational experience to a level which could not be considered a substitute for the one offered now. In the use of the forest for recreation, primary benefits accruing to the government of Alberta, as opposed to the society as a whole, would be any revenues

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[1] Hanson, Forest Utilization and Its Environmental Effects in Alberta.

[2] John Krutilla, "Conservation Reconsidered", American Economic Review, LIX (September, 1967), pp. 777-786.

collected in the form of entrance fees. The use of the forest resource in wood production would yield primary benefits, for example, in the form of revenue paid to the government of Alberta for timber dues, holding and protection charges and other service charges.

Secondary benefits are those which stem from or are induced by any project or use of a resource. Secondary benefits, to the people of Alberta, derivable from the recreational use of the forest include non-resident expenditures on goods and services associated with the use of the recreational facility -- for example, gas and lodging. Expenditures by Albertans, assuming full employment of resources, would be regarded as a transfer of income. With regards to wood production, secondary benefits to society would be associated with further processing of the timber.

In order to establish the net benefits of a project or resource use it is necessary to consider the costs -- to both the government in its role of management of the timber resources and to society as a whole -- of the action followed. Primary costs of recreation would consist of maintenance of facilities and access to recreational sites. Primary costs of wood production are administration and management, for example, fire protection and reforestation. Secondary costs of recreation would be represented by any additional costs incurred in the provision of associated goods and services to non-residents. Secondary costs of wood production may be provision of additional services to the industry.

The central issue of this study relates back to the primary benefits derivable from the use of the forest resource, and particularly to the "intangible" or extra-market benefits accruing to recreational users. There is a market established between the government of Alberta and a prospective wood producer, the latter purchasing the right to use the resource as an input into his industry. The prospective recreationist, on the other hand, has no such market in which to express the price he is willing to pay for the exclusive use of the same resource. In other words, recreation is a non-marketed commodity. It follows that when there is no market in which the recreationist may express the value he places on a recreational opportunity, this major component of the primary benefits to be derived from such use of any resource also becomes very difficult to measure. In the summation of benefits, which are subsequently compared to costs, the exclusion of these extra-market benefits renders any comparison meaningless. As Biswas and Coomber say of the situation:

> These elements have been considered until recently to be an immeasurable part of project evaluation, and no monetary value could be imposed on the value of such a resource, almost by definition. This extra summation was either ignored or included as a final weighting of the decision-making process, on a presence-absence basis.[1]

The task then becomes that of simulating a market situation

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[1]Nicholas H. Coomber and Asit K. Biswas, Evaluation of Environmental Intangibles (New York: General Press, 1973), p. 1.

for the recreational use of the forest resource. This simulated market situation allows for the estimation of a price-quantity relationship, or a demand function. With the establishment of the demand function, other analysis, such as the estimation of extra-market benefits and the value of the forest resource in recreational use, becomes possible.

The Recreational Value of the Forest Resource

There is no attempt in the Hanson Report to assess the recreational value of the forest resource, but of it he states:

> The recreational values of the forest lands in Alberta have been known since forest reserves were established in the first decade of this century, but until recently these values were not fully appreciated.[1]

In conclusion Hanson realizes the necessity of the inclusion of such values in management decision-making:

> Alberta is in a new era in which the demand for all natural resources, including the recreational amenities of wildland, is high and continuing to rise. Land and land resources are becoming scarce and if one recommendation is to come from this report it is that decisions concerning the use of the forest lands should be made cautiously, based upon the evaluation of all available information.[2]

Both the Schultz and Environmental Planning and Engineering Consulting (E.P.E.C.) Reports support the view that the demand

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[1] Hanson, Forest Utilization and Its Environmental Effects in Alberta, p. 48.

[2] Ibid., p. 64.

for recreation is increasing each year. For instance, the Schultz Report estimates that this demand is growing at the rate of 10 percent per year and is a function of the following factors:[1]

(1) growing population

(2) increased urban population

(3) increased mobility of the population

(4) increased leisure time

(5) increased percentage of family income being allocated for recreational use

(6) a diversification of recreational demands

(7) the increasing population of Canada and a general westward shift

(8) increased tourism as a form of recreation and of reaching recreational areas.

The premise is that as each of these socio-economic factors changes over time, so will the demand for recreation of which they are an integral part. No attempt is made at projection of recreational demand, but rather the authors limit themselves to this clear, widely accepted reasoning which underlies all recreational study.

The E.P.E.C. Report, on the other hand, is much more heroic in its approach. Projections of future "demand" are made by simply extrapolating rather dubious measures of present consumption. The measure of present consumption is separated into four areas:

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[1] C.D. Schultz and Company, The Environmental Effects of Timber Harvesting Operations in theEdson and Grande Prairie Forests of Alberta, p. 7.

(1) Visits from within Alberta

(2) Visits from other provinces in Canada

(3) Visits from the United States

(4) Visits from overseas.[1]

Taking as examples, visits from within Alberta, and visits from overseas, the dubious nature of the measure of present consumption arises in the following manner. The number of outdoor recreational trips taken by Albertans outside the Provincial and National Parks is assumed to be equal to the observed number of trips inside such areas. This yields a figure of eleven trips per person in 1971 throughout the Province.[2] Estimation of the number of recreational trips taken by persons from overseas is also questionable. With respect to this estimation the E.P.E.C. Report states:

> No data is available regarding what percentage of these visitors participate in outdoor recreation. However it is known that the main purpose of the majority of the visitors is to visit friends and relatives. Despite this fact, it is extremely likely that even if the overseas visitor is staying in a private home, his host will take him on weekend and/or day trips. Consequently we shall assume that all overseas visitors to Alberta pursue outdoor recreational activities.[3]

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[1] E.P.E.C. Consulting Ltd. and C.L. Sibbald Agri-Business Ltd., The Forest Resource in Alberta: An Examination with Respect to Conservation, Recreation and the Forest Industry, p. 33.

[2] E.P.E.C. Consulting Ltd. and C.L. Sibbald Agri-Business Ltd., The Forest Resource in Alberta: An Examination with Respect to Conservation, Recreation and the Forest Industry, p. 33.

[3] Ibid., p. 39.

The accepted constraints, income and leisure time, etc., to participation in recreational activities are recognized. With respect to recreational "demand" the Report then goes on to say:

> It is perhaps more useful to consider actual present consumption and the potential demand at some future time when it is expected most of the constraints will have been overcome. Recreational demand would thus be deemed to fall someplace between these two extreme figures.[1]

Based upon the estimated present consumption or participation figures from within the province of Alberta, as outlined previously, it is assessed that:

> Assuming that facilities are available and accessible, two million Albertans will each spend 51 days per year pursuing outdoor recreation in Alberta, at an average cost of $5.00 per day (no adjustment for inflation) for a total expenditure of about $510,000,000.[2]

Similar projections for each of the other three visitor groups listed above leads to the following:

> . . . the number of outdoor recreationists in Alberta will more than double by 1985 to 4.85 million, the total number of recreation days will more than triple to 134 million and the total recreation expenditures will almost quadruple to $830 million.[3]

The E.P.E.C. study has, in fact, not estimated the demand

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[1] Ibid., p. 31.

[2] Ibid., p. 53.

[3] Ibid., p. 57.

for recreation at all -- that is, no price-quantity relationship has been established; rather, it is the size of the tourist industry which has been evaluated. Subtracting the expenditures by Albertans from the estimated total recreation expenditures yields a figure of $320 million. This is simply an indication of the secondary benefits to be derived from tourism in Alberta. Assuming full employment, the $510 million estimated total expenditures by Albertans may be regarded as a transfer of income. The study by no means touches on the central problem of evaluating the extra-market primary benefits derivable by users of a recreational resource. To reiterate, secondary benefits arise indirectly, simply because of the existence of a recreational area. Assuming full employment of resources in the Alberta economy, secondary benefits are evaluated as the money spent on goods and services by non-residents, as they pursue recreational opportunities available in the province.

The error is further compounded in the E.P.E.C. Report as it attempts to estimate the value of forest land when allocated to recreational use:

> It was estimated . . . that residents spend $15 million and non-residents $2.5 million on big game hunting in Alberta during 1968. If it is assumed that $10 million of this were spent on big game hunting in the 40,000 square mile forest area readily accessible to recreationists . . . a value of $250 per square mile per annum is obtained. Certain areas, especially in the foothills, would have much higher value for hunting than this.

> For purposes of illustration it shall be assumed that intensive outdoor recreational expenditures in the accessible forest lands of Alberta are equal to the wilderness expenditures in these areas. However, since these intensive activities will be confined to 5% of the forest land (if the suggestion in Chapter V is adopted) the value of forest land reserved for intensive recreational use would be in the order of $10,000 per square mile per annum. This figure also has the potential of increasing by a factor of three over the next 15 years.[1]

Valuing the recreational use of the forest resource in a manner following E.P.E.C. is akin to the gross expenditure method of benefit estimation -- a method, it will be shown in Chapter III, which suffers in terms of economic methodology. The foregoing estimates therefore measure the magnitude of the recreational industry for the entire province of Alberta, and are not a measure of recreation demand.

Summary

Three reports on the forest resource in Alberta have been looked at in some detail. Each of these reports was prepared as background material for the public hearings on the Eastern Slopes. Their purpose was to present the issues involved in the utilization of the forest resource, in the province of Alberta, now and in the future.

Necessary concepts and considerations for the study of

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[1] Ibid., pp. 77-78.

natural resource use were introduced and their presence or absence in each of the three reports was indicated.

Briefly, the forest was recognized as a flow resource with a critical zone in quantitative and qualitative terms. The practice of sustained yield management was described as that which ensures the quantitative regeneration of the forest resource, but does not guarantee that the resource will not be depleted beyond its qualitative critical zone, or beyond the level at which it may be regenerated, naturally or by man, to the standards of quality sufficient to support other uses.

The forest may be regarded as an input, directly or indirectly, into many products. The possible alternative uses of the forest resource were listed. Two activities, wood production and recreation, were taken as examples of possible conflicts in use. With a policy of sustained yield management, the quantitative regeneration of the resource for the wood products industry is guaranteed over the years to come. However, such management practices may deplete the same resource beyond its qualitative critical zone for recreational use. In other words, even though the forest may exist in quantity, it may not be an aesthetically pleasing input into the recreational experience.

An alternative to sustained yield management of the forest resource is the management of the resource so that it may fulfill a variety of needs or satisfy the requirements of many uses. This is a policy of multiple use whereby the benefits to be derived from

each of the uses may be less than if the forest were managed for that use alone, but over time and over uses the net benefits to society are greater than those derivable from single purpose management.

Application of a multiple use policy requires that the primary and secondary benefits and costs of each use be fully quantifiable and in the same units of measurement. Only in this way can comparisons of alternate uses be made in a meaningful way and the policy of multiple use be implemented to maximize the net benefits to society now and in the future.

Some benefits associated with use of the forest may not be directly measurable, and are often excluded from the calculation of net benefit estimation. One of these is the quantity of primary benefits derived by users of the resource for recreational purposes. There is no market in which the recreationist may express the amount he is willing to pay for the recreational use of the resource. For this reason, other analyses, such as benefit estimation, are impossible. An expression of willingness to pay for various quantities of use of a resource is termed a demand function. Surrogate evaluation of this price-quantity relationship allows for the evaluation of the extra-market benefits associated with the recreational use of the resource in units comparable to other uses.

This paper shall now address itself to the methods derived for the estimation of this price-quantity relationship, and to the

theoretically sound analyses which may follow from the establishment of the demand curve.

CHAPTER III

Techniques Employed to Estimate the Value of Recreation

Introduction

Attempts to solve the problem of estimating the benefits associated with the recreational use of a resource or area have resulted in various methods of measurement. However, as Knetsch and Davis observe: "Some of the measures are clearly incorrect, others attempt to measure appropriate values but fall short on empirical grounds."[1]

The basic reasoning and major shortcomings of these less accepted measures will be the first area of concern in this review of relevant literature. Following consideration of the faults inherent in such methods of recreational resource evaluation, it becomes necessary to restate the initial problem posed in this study. The free, or low cost, provision of many recreational amenities, particularly those associated with natural resources, prevents the users from registering their evaluation of them in the market place. The logical step is to attempt to estimate this evaluation.

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[1] Jack L. Knetsch and Robert K. Davis, "Comparison of Methods for Recreation Evaluation", in Water Research, ed. by Allen V. Kneese and Stephen C. Smith (Baltimore: The Johns Hopkins Press, 1966), p. 128.

This is, in fact, the basis of the more tenable evaluation techniques used to estimate statistical demand curves for non-priced recreational resources. Three major acceptable methods of demand estimation have been developed. They are the Direct Method, the Pearse Method and the Hotelling-Clawson Method. Given the specification of the demand function, opinions diverge as to the appropriate measure of the value of recreation. Together with the methods of demand estimation outlined above, two such measures will be outlined in this study -- the monopoly revenue approach and the consumer surplus or discriminating monopoly revenue approach -- constituting the remainder of this review of the relevant literature.

Methodologically Weaker Methods of Recreation Benefit Estimation[1]

The Market Value of Product Method

This technique implies that the tangible product of any recreational experience is an indication of the value of that experience to the recreationist. For example, the recreational value of a fishing trip or hunting expedition is accordingly equal to the market value of the game caught. This method suggests that the relevant good under consideration is the game, rather than the enjoyment of the pastime itself.

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[1] Ibid., p. 128.

The Gross Expenditure Method

This second method attempts to estimate the value of a recreational area by observing the expenditures made by recreationists. Gross expenditure is a value inclusive of travel expenses to and from the site, equipment costs and expenses incurred while at the recreation site. Assuming that such expenditures would not have been made, had not the individual received at least that value in the form of recreational enjoyment, it is asserted that the recreational benefits must be at least equal to the costs incurred. However, in reality: "It is the margin above the cost of taking advantage of the recreation opportunity which measures the real monetary value that would be lost if the recreational opportunity were not available."[1] Consequently, neither the loss sustained by removal of the recreation opportunity, nor the net gain from new recreational opportunity, is measured by the gross expenditure method. The gross expenditure figure is an indication of the magnitude of the recreation industry; it cannot be construed as an evaluation of the benefits derived from a recreational facility.

The Cost Method

This third technique is an extension of the reasoning underlying the gross expenditure method. It imparts to the recreation facility a value equal to the cost of its establishment.

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[1]Marion Clawson and Jack L. Knetsch, Economics of Outdoor Recreation, (Baltimore: The Johns Hopkins Press, 1971), p. 225.

Regarding the application of this method to fishery resources, Crutchfield says the following:

> In effect we add together costs of providing or developing the fishery, costs of reaching the fishing area, and costs of the necessary gear. This produces a close approximation to gross market value but, as indicated previously this figure is not particularly useful.[1]

The Market Value Method

In the application of this method, a schedule of charges is established; these are then multiplied by attendance figures to yield the value of the recreational resource or area. The basic idea that value is reflected by visitors' willingness to pay charges is acceptable. The use of fees at private areas as a proxy for the hypothetical charges at public facilities is, on the other hand, a dubious step. The recreation at each is not the same product. As Knetsch and Davis state: "It is in part because private areas are not fully comparable with public areas that users are willing to pay fees or charges."[2]

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[1] James A. Crutchfield, "Valuation of Fishery Resources", Land Economics, XXXVIII (May, 1962), p. 149.

[2] Knetsch and Davis, "Comparison of Methods for Recreation Evaluation", in Water Research, p. 128.

Methodologically Stronger Methods of Recreation Benefit Estimation

Throughout the methods outlined above, there is no attempt to estimate a statistical demand curve for the recreational resource in question. The following techniques do, however, lead to the establishment of such an estimated demand curve -- that is, the curve indicating the functional relationship between the price and quantity demanded of the resource. As Knetsch and Davis state:

> Conceptually, we wish to measure the willingness to pay by consumers of outdoor recreation services as though these consumers were purchasing the services in an open market.[1]

These techniques attempt to measure such willingness to pay.

The Direct Method

In the case of the Direct Method, the information necessary to determine such a relationship is gained by interviewing the recreationists involved. The interview reflects the price individuals would be willing to pay, ceteris paribus, if the recreational resource were marketed in the usual manner.

Some limitations are inherent in this approach. Asking the recreationist how much he would be willing to pay for a commodity which is presently provided free of charge, or at a minimal price, may lead to a source of bias in the following way.[2] The individual

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[1] Ibid., p. 125.

[2] The existence or non-existence of such bias has not been empirically substantiated.

may feel that if he understates his willingness to pay, then he will avoid higher prices should the resource become subject to a charge. Conversely, the attitude expressed may be that preservation of the resource for recreation will be more likely if the willingness to pay is overstated.[1] The emotive response evoked by questions concerning recreation resources may lead to statements of willingness to pay which, if the hypothetical situation were to become fact, would not be backed by money.[2]

In the practical application of the interview method, there are essentially two ways in which the question concerning willingness to pay may be phrased. The first asks of the recreationist the amount he would be willing to pay for a given quantity of recreational use associated with the resource. The second mode of questioning would yield information with respect to the minimum amount of money the recreationist would accept to forego the opportunity of taking advantage of the recreational facility under consideration.[3]

Within this framework Hicks has identified two different types of consumer surplus. The first phrasing of the question will measure compensating surplus. Hicks defines this form of

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[1] Ibid., p. 127.

[2] See P.H. Pearse, "A New Approach to the Evaluation of Non-Priced Recreational Resources," Land Economics, XLIV (February 1968), pp. 87-99.

[3] See Crutchfield, "Valuation of Fishery Resources".

consumer surplus as: "the maximum amount of money which a consumer, in the A-situation, would pay for a ticket entitling him to buy certain commodities at B-prices . . ."[1] The second form of questioning will, on the other hand, identify the consumers' surplus which is, in Hicks' terminology, "the equivalent surplus": an amount the consumer would accept "if he had been given it (the ticket) free and was to be persuaded to return it."[2] Of the two types of question, and the resulting estimates of value, Pearse suggests that: ". . . they are unlikely to be equal because they measure two different forms of consumer surplus."[3]

The Hotelling-Clawson Method

In the development of this technique of demand estimation, the delineation of concentric zones around a recreation area was initially made by Harold Hotelling. With the determination of the cost of travel from each of these concentric zones, a price proxy is established. This price proxy in turn, is related to the number of persons observed to visit the recreation area from the various zones. The resulting demand curve may be termed the demand for the entire recreational experience.[4]

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[1] J.R. Hicks, A Revision of Demand Theory (Oxford: The Clarendon Press, 1959), p. 177.

[2] Ibid.

[3] Pearse, "A New Approach to the Evaluation of Non-Priced Recreational Resources", p. 88.

[4] See Clawson and Knetsch, Economics of Outdoor Recreation.

It was subsequently suggested by Marion Clawson that the recreational experience consisted of five phases: (1) anticipation of the trip, (2) travel to the recreational site, (3) the on-site experience, (4) return travel from the site, and (5) recollection of the experience.[1] The following outline of the Hotelling-Clawson analysis is, therefore, a culmination of the original work of Harold Hotelling and the subsequent expansion to a two-stage estimation of the demand for the recreational site itself, as developed by Marion Clawson.

The quantity variable is expressed in visits per thousand population. The reason for the computation of attendance figures on a per thousand population basis is that it adjusts for population differences among the distance zones. At the first stage a demand curve for the entire recreational experience is established. Increasing price, measured by increasing distance and associated travel costs, is related to decreasing quantity demanded, as measured by visits per thousand population.

The second stage of this method is to establish a demand curve for the recreational resource itself. "Wherever it is possible to estimate a demand curve for the whole experience (as we have done for earlier examples) it is possible to estimate one for the recreation resource involved."[2] By introducing a series

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[1] Ibid., p. 33.

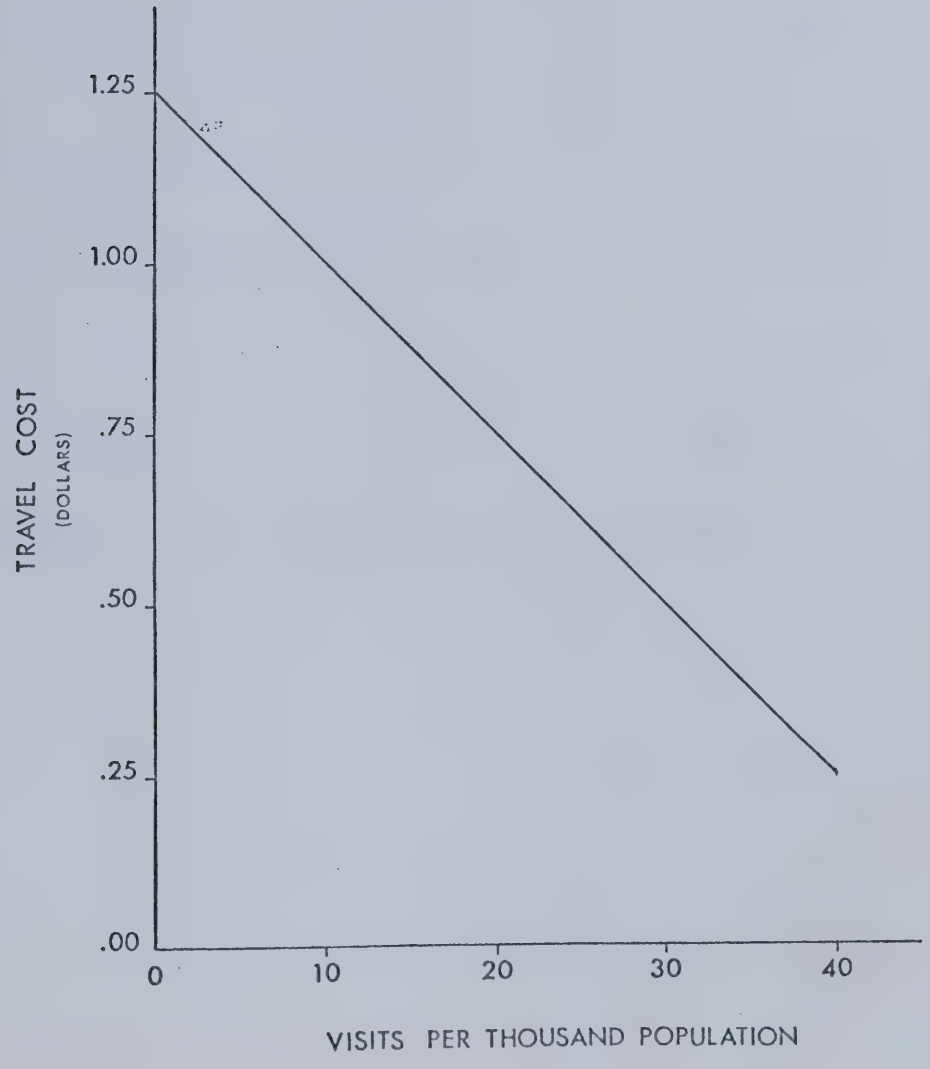
[2] Ibid., p. 78.

of hypothetical tolls or fees, and measuring the predicted response of recreationists, the demand curve for the resource may be established. This stage is based upon two very important assumptions. The first is that the recreationists will respond to the toll or fee as they would to an increase in travel costs. However, considering that increasing tolls or fees would, for recreationists from nearer zones, become an increasingly larger portion of total expenses, it may be expected that this would decrease attendance to a greater degree than for more distant visitors. The second assumption is that of rationality or predictability. Essentially this implies that the average reaction of a group of consumers, to a price change, will be similar to that of another group. If the visitors from the closest concentric zone, say E, have travel costs of $10.00 with a related use rate of 200 visits per thousand population, and those from zone A face costs of $20.00 per visit at a visitation rate of 100 per thousand population, then if the costs of those in zone E are increased by $10.00 (by the hypothetical toll or fee) the visitation rate from zone E will also be 100 per thousand population. Increasing prices, now represented by increasing tolls or fees, over and above the access cost, related to total visits (calculated from the visits per thousand population figure) yields a demand curve for the recreational resource.

A simplified version of the Hotelling-Clawson Method is shown diagrammatically in Figure III-1. This indicates the

Figure III-1

HYPOTHETICAL TRAVEL COST AND VISITS PER THOUSAND POPULATION



relationship between travel costs and observed visits per thousand population from each centre. This is the Hotelling-Clawson 'initial demand curve'. Imposition of a schedule of fees or charges determines the 'final demand curve' as shown in Figure III-2. The following numerical example demonstrates the process.

TABLE III-1

HYPOTHETICAL VISITS PER THOUSAND POPULATION FROM CENTRES OF ORIGIN

Centre	Travel Cost	Visits/1000 population
A	$1.25	0
B	1.00	10
C	.75	20
D	.50	30
E	.25	40

Figure III-2

HYPOTHETICAL VISITS WITH THE IMPOSITION OF ADMISSION CHARGES

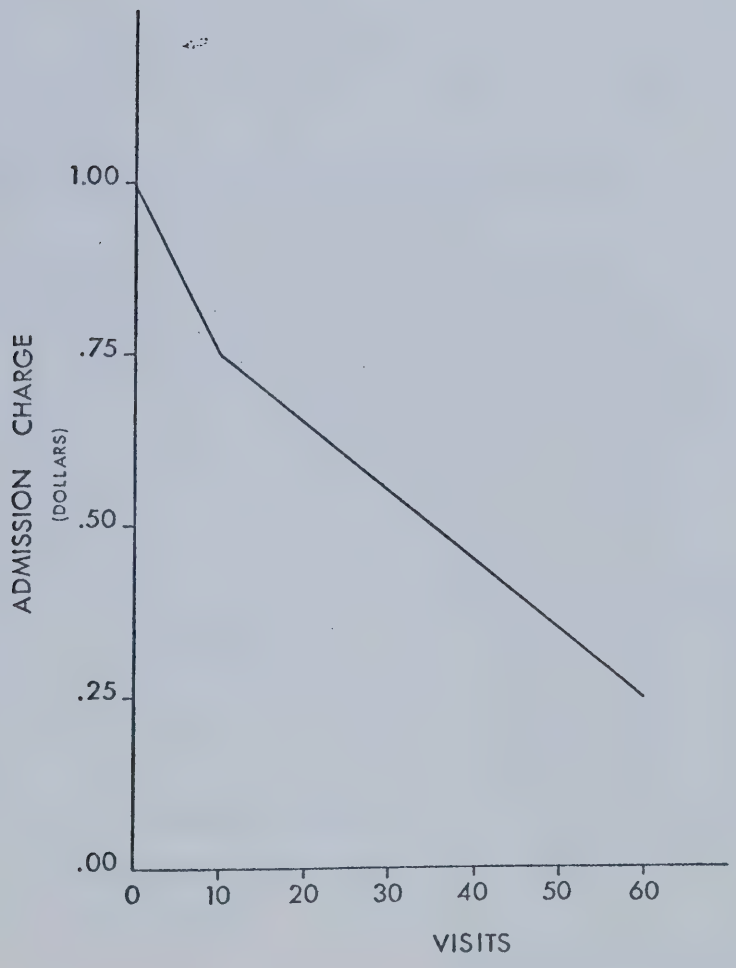


TABLE III-2

HYPOTHETICAL VISITS OBSERVED WITH THE IMPOSITION OF ADMISSION CHARGES

Centre	$1.00	$ .75	$ .50	$ .25
A	-	-	-	-
B	-	-	-	-
C	-	-	-	10
D	-	-	10	20
E	-	10	20	30
Total	-	10	30	60

The recreational benefits associated with the facility are then typically measured as the total area under the demand curve.

The assumption of rationality, or similar reactions, mentioned above adds less obvious limitations to the analysis. In considering visits from near and distant zones it is necessary to assume:[1]

(1) that for all distance zones from which visitors originate, and for all visitors within these zones, the marginal utility of income is equal;

(2) that the increasing time foregone with increasing distance travelled is fully accounted for in greater money cost;

[1] See Clawson and Knetsch, Economics of Outdoor Recreation, pp. 86-89.

(3) that identical substitutes, or lack thereof, for the recreation resource in question exist for all visitors;

(4) that the visit to the recreational resource is the sole purpose of the trip, that is to say that attractions en route do not affect the willingness to pay for access to the recreational resource in question.

The first assumption is alternatively known as that of homogeneity -- it is the least acceptable necessary to the Hotelling-Clawson Method. In the estimation of the price variable associated with various distance zones, it is also assumed that the travel costs of the recreationists are equal. This assumption is acceptable provided that the condition of a generally uniform mode of transportation among recreationists is not violated.

The Pearse Method

Disagreement with the assumptions necessary for the Hotelling-Clawson Method led P.H. Pearse to develop a new technique for estimation of the value of recreational resources.

The first step in this approach is to separate the users of a given recreational facility into income groups. The fixed costs of each recreationist are then calculated. These fixed costs are taken to include items such as the cost of travel,

licenses and so on. They are termed fixed costs since they are invariant with the number of days spent at the recreational facility. The quantity variable is the number of visits made by a recreationist within a given time period. Within each income group, a marginal recreationist is identified as the individual who faces the highest total fixed cost of that group. The marginal recreationist within each income group is said to enjoy no consumer surplus. That the individual, of a given income group, facing the highest fixed costs is, in fact, the marginal consumer of that group, is an extremely important assumption. Pearse cautions:

> Clearly the sample of recreationists and the number of income groups into which they are grouped ought to be selected to minimize variation in income groups, while including enough observations so that all are not at or near the margin but there is a good possibility that at least one is.[1]

Underlying the statement that the recreationist facing the highest fixed costs enjoys no consumer surplus is the reasoning that this is the maximum amount people of this income group would be willing to pay in order to acquire the recreational experience in question. Alternatively, the difference between this maximum level of fixed costs, and the fixed costs of each recreationist, is equal to the maximum amount each (in that

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[1]Pearse, "A New Approach to the Evaluation of Non-Priced Recreational Resources", p. 94.

income group) would be willing to pay over and above his actual costs. In other words, each recreationist is willing to pay up to the level of the marginal recreationist of his income group. The crucial assumption here is: ". . . that recreationists with similar incomes, who have also demonstrated a similarity of tastes to the extent that they have pursued the same recreational experience, are equally willing to pay for the recreation."[1]

It is with the assumption of homogeneity of individuals and base populations, necessary in the Hotelling-Clawson Method, that Pearse is in strong disagreement. However, Norton makes the following comment on the assumption of constant willingness to pay within income groups, essential to the Pearse Method: "Pearse merely diverts this fundamental assumption to income groups, with the supposition that visitors within the same income category have identical indifference maps for recreation."[2]

In the Pearse Method, the maximum each recreationist would be willing to pay over and above actual costs (equivalent to a maximum tolerable toll or fee) is then summed for all visitors to the facility and the consumers' surplus generated under free access is evaluated. All visitors regardless of income class may be ranked according to the maximum tolerable fee they would pay,

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[1] Ibid.

[2] G.A. Norton, "Public Outdoor Recreation and Resource Allocation: A Welfare Approach", Land Economics, XLVI (1970), p. 414.

yielding a demand curve for the resource equivalent to that of the second stage Hotelling-Clawson demand curve. "The total area under this demand curve represents the value of the non-price recreational resource."[1]

Two assumptions, in addition to those outlined above, are made by Pearse. These assumptions are also found in the Hotelling-Clawson Method. The first is that recreationists will respond to a toll in the same way that they respond to an equal increment in travel costs. The second is that the enjoyment of the recreation associated with the site in question is the sole purpose of the trip.

Benefit Estimation

Given an estimate of the demand for a recreational resource or facility, there are two basic approaches to the calculation of the value of that resource or facility in recreational use.

The first of these techniques of value estimation involves the determination of the maximum revenue a non-discriminating monopolist could derive from the recreational demand for the facility in question. The value of the recreational facility is taken as being equal to what it would be to a profit-maximizing sole owner.

At each price level, taken as the increasing costs over

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[1]Pearse, "A New Approach to the Evaluation of Non-Priced Recreational Resources", p. 93.

and above travel costs faced by the recreationist, as in the Hotelling-Clawson final demand curve, the associated quantity demanded is multiplied by that price to yield a total revenue figure. The revenue may be computed in various temporal units. If the final demand curve for the recreational resource or facility is expressed in visits per day, the resulting revenue figures may be taken on a daily basis, or they may be appropriately computed to yield a yearly revenue estimate.

The point of unitary elasticity on the final demand curve, coincident with zero marginal revenue, establishes the profit maximizing price and associated quantity demanded which would yield maximum revenue to the owner of the recreational facility. This theoretically attainable revenue may be inferred as the extra-market benefits accruing to the recreational users of the resource or facility under consideration.

The second technique of estimating the value of a recreational resource or facility is based upon the amount a discriminating monopolist could potentially collect by charging various levels of entrance fees to the visitors originating from given distances. This estimate is alternatively termed the consumers' surplus associated with the amenity in question. The travel cost plus consumer surplus is the amount the recreationist is willing to pay for the entire recreational experience. The consumers' surplus measures the costs that the recreationists would have been willing to pay, but were not required to pay. The appropriate

measure of consumers' surplus is, therefore, the area under the final demand curve for the recreational resource -- that is, the total amount above travel costs that all the recreationists would have been willing to pay for access to the facility. To establish whether or not consumers' surplus, measured as the area under the final demand curve, is, in fact, the appropriate measure of value or extra-market benefits, it is necessary to consider the nature of the good. As stated previously, the provision of outdoor recreation, partly due to its intrinsic characteristics and partly due to institutional and historical reasons, has public good characteristics. In consideration of the demand curves for public as opposed to private goods, Winch states:

> The demand curve for a public good is the vertical sum of individuals' demand curves, while for a private good it is the horizontal sum. The demand curve for a public good shows the aggregate amount that all would pay to enjoy the same units, while the demand curve for a private good shows the aggregate number of units consumers would consume separately at the same price for each.[1]

The difference between the two corresponds closely to the fact that, "the relevant measure of benefits should be total utility provided by the project or value in use and not value in exchange".[2]

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[1] D.M. Winch, Analytical Welfare Economics (Middlesex, England: Penguin Books Ltd., 1971), p. 122.

[2] P. Davidson, "The Valuation of Public Goods", Economics of the Environment. Dorfman and Dorfman, eds. (New York: W.W. Norton and Company, Inc., 1972), p. 346.

The value in use of a good with public good characteristics and which is provided free is, therefore, the area under the demand curve for that good. As Davidson points out:

> It is important to note that what are being vertically added in the public goods case are areas under individual demand curves. This involves the summation of consumer surpluses or the value in use for each consumer.[1]

Inherent in the application of the measure of the area under the demand curve as being equal to the consumers' surplus, or value in use, is the assumption that the marginal utility of money is constant. Taking the area under the demand curve as a measure of consumers' surplus, or value in use, is only appropriate when:[2]

(1) the demand curve is a Hicks' income-compensated demand curve;

(2) the demand curve is an empirically estimated one for a good or service for which the income effect is zero or at least relatively small; or

(3) the marginal utility of money income is constant among all users.

As stated previously a discriminating monopolist could charge an amount equal to the consumers' surplus. Therefore, in

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[1] P. Davidson, "The Valuation of Public Goods", p. 350.

[2] See D.M. Winch, Analytical Welfare Economics, pp. 135-151. This point is directly related to the assumption of homogeneity which, it was pointed out, is a limitation to the Hotelling-Clawson technique.

this case, the area under the demand curve for the recreational resource is taken to be its value, or the extra-market benefits accruing to its users.

Summary

Together with some less acceptable techniques, three of the more tenable methods of estimating the demand for non-priced recreational resources have been examined in some detail. The methodology, assumptions and limitations of each have been determined with particular emphasis being placed on the Direct Method, the Pearse Method and the Hotelling-Clawson Method. In the following section of this study, the Hotelling-Clawson Method, with some variations, will be used to estimate the recreational demand of the Clearwater-Rocky Forest as it existed in 1972. From among the three techniques which measure willingness to pay, the appropriate measure of primary benefits associated with the recreational use of a resource or area, the Hotelling-Clawson was chosen primarily because of the data base. An indication of the users' willingness to pay in accordance with the Direct Method was not available from the questionnaires completed. Data related to income, sufficiently accurate to identify the "marginal consumer" in accordance with the Pearse Method, was also unavailable from the questionnaire results. To reiterate, the decision to apply the Hotelling-Clawson technique was made on the basis of data availability, not on the basis of the theoretical superiority of this

technique over the others which also estimate willingness to pay.

It has also been pointed out that, given an estimated statistical demand curve for a non-priced recreational resource, there exist essentially two techniques for placing a value on that recreational resource. They are the monopoly revenue approach and the consumer surplus or discriminating monopoly revenue approach. Values to be placed upon the recreational use of the Clearwater-Rocky Forest, in terms of the application of the consumer surplus approach, will be the subject of Chapter V of the study.

CHAPTER IV

Empirical Investigation of Factors Influencing Recreational Demand of the Forest Resource in Alberta

Introduction

The purpose of the first section of this chapter is to relate the Hotelling-Clawson technique of benefit estimation to the theory of consumer demand. The empirical data generated will be applied initially to the estimation of simplified first stage demand functions implicit in the Hotelling-Clawson methodology. More in-depth analysis in terms of socio-economic variables influencing demand will also be undertaken. The result of the empirical investigation is an estimated demand curve for the entire recreational experience, which may then be used to estimate the demand curve for the recreational site itself (the final demand curve of the Hotelling-Clawson technique). Together with the estimation of the final demand curve, the subsequent estimation of benefits to be derived from the recreational use of part of the Alberta forest resource is undertaken in Chapter V.

The area chosen for a case study in the investigation of factors influencing recreational demand was the Clearwater-Rocky Forest, located in west-central Alberta. In 1972 a user survey of this area was completed by the Forest Land Use Branch of the Alberta

Department of Land and Forests (now Alberta Energy and Natural Resources).

Within the Clearwater-Rocky Forest, as in other forest reserves, the recreational facilities are mainly natural, rather than developed. Among the activities participated in by recreationists are picnicking, camping, driving, sightseeing, walking and hiking. This empirical study is not an attempt to evaluate the benefits derived from specific activities, but rather to demonstrate the potential applicability of the Hotelling-Clawson method in estimating the benefits to be derived from the recreational use of the forest resource -- a resource which offers the opportunity for participation in these activities. Future development of site-specific recreational facilities must be concerned with the preferences of consumers for these individual activities. This study limits itself to the evaluation of the forest reserve as a recreational resource.

General Determinants of Demand

The theory of consumer behaviour postulates that individual consumer demand for a good is a function of all prices (the price of the commodity in question and the prices of related commodities -- that is substitutes and complements) and of money income.[1] These four factors, together with the size of population, determine the aggregate level of demand.

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[1] C. Ferguson, Microeconomic Theory (Boston: Irwin, 1968), p. 42.

It has been argued that outdoor recreation cannot be subjected to conventional economic demand analysis because there is simply no price to which the observed quantity demanded may be related, yielding a meaningful demand function. Without a demand function, further analysis is impossible.

The objective of the Hotelling-Clawson Method is to derive a ceteris paribus demand curve for the recreational use of an area by indicating the visitation rate (measured in visits) associated with increasing entrance fees. In other words, in its simplest form, the Hotelling-Clawson Model assumes that all other determinants of the level of demand, except own price, are constant. It takes into consideration only the relationship between a surrogate price and the observed quantity demanded.[1]

The Recreation Demand Model for the Clearwater-Rocky Forest

In this study, an empirical investigation utilizing the Hotelling-Clawson technique was undertaken. Three general specifications of the recreation demand function were studied:

(i) $Q = f(P)$

(ii) $Q = f(P,Y)$

(iii) $Q = f(P,Y,U)$

where Q = visits per thousand population

P = a surrogate price estimated by travel cost

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[1] A detailed explanation of the Hotelling-Clawson technique is given in Chapter III.

Y = average income of visitors from a given centre

U = a measure of the level of urbanization of a given centre.

In the first relationship the quantity of visits was observed as a function of price, where price is the key independent variable determining the quantity demanded.

In addition to the simple relationship between price and quantity demanded, it was attempted to estimate the level of demand by including income as an explanatory variable. In this manner, the estimated relationship between the dependent and independent variables more closely approaches that of conventional demand theory. The estimated relationship does, however, fall short of conventional demand theory with the exclusion of the demand determinant, the prices of related commodities. The inclusion of the prices of related commodities would be extremely difficult in the case of recreational demand, especially in terms of substitutes. The attempt to identify potential substitutes for the recreational opportunities offered by the forest resource was not made in consideration of the difficulty associated with such identification.

Among the more general socio-economic variables which have been included in studies of a similar nature are the following: the age of the head of the household, educational level, race and population levels. The socio-economic variable chosen for application in this study was a measure of the degree of urbanization of the centres of origin. This was included in the belief that the density of population of any given centre would have some

effect on the number of recreational visits to the forest resource generated by that centre.

Choice of Functional Form

In order to estimate the demand curve for the entire recreational experience, three forms of equation were fitted to each of the specifications outlined previously. The first was a simple linear functional form which resulted in the following for each of the three specifications:

(1) $Q = a_o + a_1P + e;$

(2) $Q = a_o + a_1P + a_2Y + e;$

(3) $Q = a_o + a_1P + a_2Y + a_3U + e;$

where Q = visits per thousand population

P = estimated travel cost

Y = average income of visitors

U = a measure of urbanization

a_o, a_1, a_2, a_3 = estimated coefficients

e = the set of residuals.[1]

The essential assumption underlying this functional form of the three specifications is that a simple linear relationship exists between price and quantity demanded. A characteristic of this functional form is that at some price level the number of

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[1] These respective symbols and variables will apply to all presentations in this section of the study. For ease and clarity of exposition, the symbols correspond to those of an estimated relationship and the i denoting a set of observations has been deleted.

visits will fall to zero; alternatively, at a price level of zero, the quantity demanded will be finite.

It was also hypothesized that a non-linear relationship might exist between the travel cost faced by visitors and attendance figures. Two other functional forms, both non-linear with respect to the variables but linear with respect to the parameters to be estimated, were chosen.

In the first of these, the functional form of the equation was exponential (a simple variation of the semi-logarithmic functional form). In this case, the logarithmic operator was attached to the dependent variable for each of the specifications as follows:[1]

(4) $\text{Log}_{10}Q = a_o + a_1P + e$;

(5) $\text{Log}_{10}Q = a_o + a_1P + a_2Y + e$;

(6) $\text{Log}_{10}Q = a_o + a_1P + a_2Y + a_3U + e$.

The preceding semi-logarithmic function may be expressed in exponential form.[2] Taking the first equation in this case, the relationship may be rewritten as:

$$Q = 10^{a_o + a_1P + e}.$$

A characteristic of this functional form is that for a price of zero, the quantity demanded will be finite. However, as the price level increases, the visit rate will never fall to zero, no matter

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[1] The variables were transformed to Log_{10} format prior to the application of the OLS regression included in the ECON:ECON programme.

[2] See Jan Kmenta, Elements of Econometrics (New York: The Macmillan Company, 1971), pp. 451-462.

how high the value of the former. Also inherent in this functional form, as opposed to the semi-logarithmic form where the logarithmic operator is attached to the independent variable, is the assumption that for small increases in the price level, the quantity demanded decreases substantially. In the case where the logarithmic operator is attached to the independent variable, it is assumed that an increase in the price level leads to a minimal decrease in the quantity demanded. In other words, by imparting an exponential character to the semi-logarithmic form of the function, it is inherently assumed that the price elasticity of demand is greater than one.

The ability to estimate the above function as linear lies in the fact that this form of the equation is intrinsically linear since it inherits a linear form by a simple transformation of the dependent variable. Taking equation four, $\text{Log}_{10}Q$ may be expressed as Q^*; therefore, it may be expressed as a linear function as follows: $Q^* = a_o + a_1P + e$.

A third functional form of the equation applied to each of the specifications was the double logarithmic or multiplicative model. The functional form for each of the specifications was in this case:

(7) $\text{Log}_{10}Q = \text{Log}_{10}a_o + a_1\text{Log}_{10}P + e$;

(8) $\text{Log}_{10}Q = \text{Log}_{10}a_o + a_1\text{Log}_{10}P + a_2\text{Log}_{10}Y + e$;

(9) $\text{Log}_{10}Q = \text{Log}_{10}a_o + a_1\text{Log}_{10}P + a_2\text{Log}_{10}Y + a_3\text{Log}_{10}U + e$.

In the multiplicative form equation nine may be written as $Q = a_o P^{a_1} Y^{a_2} U^{a_3} 10^{e}$.

An example of this model is the Cobb Douglas type function where the elasticity of the dependent variable with respect to any one of the explanatory variable is equal to the estimated coefficient on the latter. For example, with respect to equation nine, the price elasticity of demand is equal to a_1; the income elasticity of demand is equal to a_2.

An important property underlying this functional form is that the curve is asymptotic to both axes. No matter how high the cost, the visit rate will never fall to zero; on the other hand, as cost approaches zero, the visit rate will rise rapidly towards infinity.

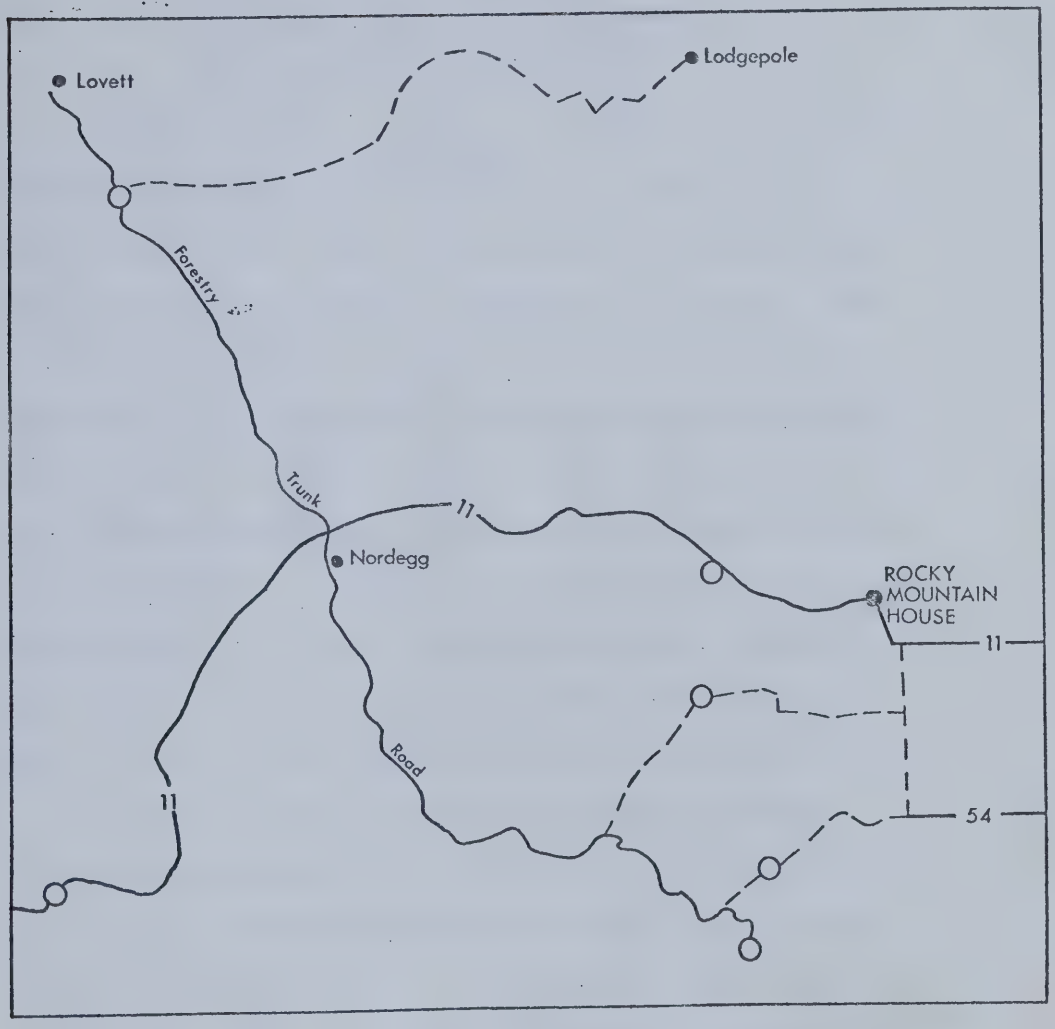
The Data

The Clearwater-Rocky user survey was conducted by an interview method. (An example of the cards completed by the interviewers is provided in Appendix A.) The location of the interview points with respect to major traffic routes is indicated in Figure IV-1.

Between May 20th and September 4th, 1972, the survey was undertaken in the Clearwater (Western) portion of the forest. A total of 5,820 interviews were completed; 3,409 of them related to recreational use of the forest. The fact that the survey was limited to the western portion of the Clearwater-Rocky Forest is

Figure IV-1

LOCATION of 1972 USER SURVEY CHECKPOINTS



○ 1972 User Survey Checkpoint

SCALE: 1 inch = 16 miles

SOURCE: 1972 Clearwater – Rocky User Survey, Alberta Lands and Forests

of minor importance in consideration of recreational use since:

> Most of the recreational interest and facilities are in the Clearwater portion where the entrance-exit access is limited to a few locations. The Rocky portion, on the other hand, has a lesser attraction to recreationists and a multitude of entrance-exit access points.[1]

Due to the rotating nature of the interviews, inclement weather, excessive traffic and other adverse conditions, an estimate of the overall use of the forest for recreation purposes was impossible. Of a total of 648 possible "check point days", only 172 were completed. That is, if each of the six check points had been attended every day for the duration of the survey, a total of 648 interview days would have been attained. If the traffic flow on days missed is assumed to have been equal to that observed when the check points were manned, the 5,820 interviews conducted by the rotating method represents a sample of approximately twenty seven percent. This major limitation inherent in the data base necessitates that the following analysis be regarded only as an example of the potential use of the Hotelling-Clawson Method, as well as of the determination of the socio-economic factors which influence attendance at resource-based recreational facilities. The resulting demand curves by no means indicate the total benefits derived from the recreational use of the forest resource.

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[1]Forest Land Use Branch, Alberta Lands and Forests, "1972 Clearwater-Rocky User Survey" (Edmonton, 1974), p. 1.

Data concerning the place of origin of visitors was taken from the 1972 Clearwater-Rocky User Survey. These points of origin and the calculated visits per thousand population from each are indicated in Appendix B. In the derivation of the initial demand curve, a slight modification was made to the basic Hotelling-Clawson Method. Data generated by the Clearwater-Rocky User Survey was not available on an individual visitor basis. It was possible only to compile the information as a number of visits observed from given centres within the province. In other words it was not possible to determine the place of origin of each and every visitor to the area. For this reason, only communities of population greater than one thousand were included in the analysis. Of a total of 3,409 interviews which were recreational in nature, 1,852 were included in this analysis. By omitting towns of population less than one thousand, slightly less than half the potential observations were eliminated. It is impossible to evaluate the exact consequences of eliminating such centres from the analysis. However, it may be said that this results in a downward bias in the estimation of the demand curve, since not all recreational visits are included in the analysis. As a result, any evaluation of the extra-market benefits stemming from the recreational use of the forest resource, based on these estimates, will also tend to be an underestimation.

In addition, the centres of origin were not separated into concentric zones around the recreational area, but rather each was

considered on an individual basis. This eliminated the problem of averaging distances travelled from within zones, as would be necessary in the conventional application of the Hotelling-Clawson Method. In consideration of distances travelled from zones, the width of the zone, and the distribution of population within it, must be taken into account. If, for example, the population of a zone is completely concentrated on the outer limit, most of the visits attributed to that zone will be associated with a travel distance greater than the average or mid-point. This modification also facilitated the generation of a number of observations more than adequate to meet the general requirements of ordinary least squares regression analysis.

The distances travelled to the recreation site were measured directly from maps of the province, and were taken to be the shortest by major traffic route, from a given point of origin, to the nearest entrance to the Clearwater-Rocky Forest. These measured distances were then multiplied by a factor of 17.3¢ to yield an estimate of travel cost. The figure of 17.3¢ is given by the Alberta Motor Association as the average cost per mile of distance travelled in a motor vehicle.[1] The estimated travel cost associated with each centre is indicated in Appendix B.

For purposes of analysis the data on visits was separated

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[1]The figure of 17.3¢ is inclusive of fixed costs such as insurance, licenses, etc., and variable costs such as gas, oil and tires, etc.. The information was taken from a pamphlet distributed by the Alberta Motor Association.

into two categories. A distinction was made between those visits which were part of an annual vacation and those which were not. It is to be expected that the reaction to an imposition of fees or admission charges would differ between the two. For visitors whose trip to the facility in question is the sole purpose of the journey, the introduction of a fee would represent an increase in costs relatively greater than that of visitors for whom the trip to the Clearwater-Rocky Forest is only part of a much larger recreational experience. The observed distance travelled, where it is part of an annual vacation, should not be attributed entirely to a willingness to pay for access to this facility alone.

Information concerning the income level of visitors was also generated by the 1972 User Survey. As indicated in Appendix A, information concerning the income level of the visitor was expressed as a range. In order to indicate an average income level, the mid-point of each range was multiplied by the number of observations corresponding to the cell; the total of these was then adjusted by the number of observations from a given centre of origin. By this technique, the income variable was computed as an average of the income levels of users from the various points of origin. The values of the income variable for respective communities are shown in Appendix B.

The measure of the degree of urbanization of the various communities is represented simply by their respective population levels. This information is also outlined in Appendix B.

The following is a brief indication of the expected results, that is, the type of relationship that would be intuitively anticipated to exist between the dependent variable, visits per thousand population, and each of the explanatory variables. As in conventional demand theory, the curve is anticipated to be downward sloping, indicating the existence of an inverse relationship between price and quantity demanded. It is expected that as both income and the degree of urbanization increase, so too will the level of demand. This implies a positive relationship between the number of visits per thousand population observed at the site, and each of these explanatory variables.

Results and Implications

The ordinary least squares regression technique was applied to each of the three functional forms of the various specifications of the demand function outlined previously. The regression results are given in Tables IV-1 to IV-3, where each table represents the general specification indicated. The three different functional forms of the equation are appropriately numbered and are, in order, the linear, exponential and double logarithmic. Where an equation is denoted by the letter A, it represents the regression results where visits were part of an annual vacation. The letter B indicates that the results are based on observations where the visits were not part of an annual vacation. The first equation in Table IV-1 shows the results of specifying the quantity demanded of

TABLE IV-1

REGRESSION RESULTS: Q = f(P)

	Constant	Price	$\bar{R}^2$	F
	16.69*	-.315*	.2216	15.52
1.A	(2.7489)	(.0799)		
	1.119*	-.019*	.3217	25.19
2.A	(0.1308)	(.0038)		
	2.5*	-1.392*	.4517	43.93
3.A	(0.3009)	(.2100)		
	36.67*	-.795*	.1367	9.39
1.B	(9.2500)	(.2590)		
	1.19*	-.021*	.3405	28.36
2.B	(0.1431)	(.004)		
	2.91*	-1.67*	.5353	62.06
3.B	(0.3085)	(.2122)		

*Significant at 1%

The standard error of each coefficient is given in brackets.

TABLE IV-2

REGRESSION RESULTS: $Q = f(P,Y)$

	Constant	Price	Income	$\bar{R}^2$	F
	22.48*	-.302	-.0016	.2150	7.98
1.A	(8.0892)	(0.0822)	(.0021)		
	1.46*	-.018*	-.000096	.3207	13.04
2.A	(0.3835)	(0.0039)	(.0001)		
	4.58	-1.36*	-.59	.4470	21.65
3.A	(2.871)	(0.2171)	(.8150)		
	43.2	-.790*	-.0018	.1209	4.64
1.B	(27.8174)	(0.2627)	(.0072)		
	1.386*	-.021	-.000053	.3305	14.08
2.B	(0.4295)	(0.004)	(.0001)		
	3.814	-1.667*	-.255	.5275	30.58
3.B	(2.9267)	(0.2144)	(.8218)		

*Significant at 1% The standard error of each coefficient is given in brackets.

TABLE IV-3

REGRESSION RESULTS: $Q = f(P,Y,U)$

	Constant	Price	Income	Population	$\bar{R}^2$	F
	20.72**	-.31*	-.00097	-.000015	.2102	5.52
1.A	(8.3832)	(0.0836)	(.0022)	(.000018)		
	1.41*	-.019*	-.000077	-.00000044	.3105	8.65
2.A	(0.3992)	(0.004)	(.001)	(.000000084)		
	3.12	-1.39*	.068	-.2352**	.4884	17.23
3.A	(2.8403)	(0.2096)	(.8387)	(.1059)		
	36.51	-.82*	.0005	-.000047	.1140	3.27
1.B	(29.2722)	(0.2668)	(.0078)	(.00006)		
	1.161*	-.022*	.000025	-.0000016***	.3546	10.71
2.B	(0.442)	(0.004)	(.0001)	(.00000092)		
	1.225	-1.7*	.784	-.297*	.5776	25.16
3.B	(2.934)	(0.2031)	(.8700)	(.1119)		

* Significant at 1%
** Significant at 5%
***Significant at 10%

The standard error of each coefficient is given in brackets.

visits which were part of an annual vacation as a function of price or travel cost. This is the linear functional form, and the value of $\bar{R}^2$ is approximately 0.22, with the independent variable significant at the 1 percent level. For the same specification the functional form was changed to an exponential. The results of this are shown in the second equation in Table IV-1. As indicated, the change to this functional form increased the value of $\bar{R}^2$ by approximately 0.1. In this case the independent variable is again significant at the 1 percent level. When the functional form of this simple demand function was changed to the double logarithmic the value of $\bar{R}^2$ again increased, to a value of approximately 0.45. Once more, the independent variable was significant at the 1 percent level. The increase in $\bar{R}^2$ attributable to changes in the functional form of this specification of the demand function also occurred where the dependent variable was visits per thousand population which were not part of an annual vacation (equations 1B, 2B and 3B of Table IV-1). For all three functional forms of this demand function, the independent variable was significant at the 1 percent level and, in the case of both vacation and non-vacation use, the sign of the coefficient on the independent variable was negative. From this result it may be stated that the demand curve is downward sloping.

When the specification of the function was changed to include income as an explanatory variable, the value of adjusted R^2 decreased for all three functional forms where visits were part

of an annual vacation as well as where they were not (see Table IV-2). As in the simpler specification, where price was the only explanatory variable, the price variable was again significant at the 1 percent level and the sign of the estimated coefficient was negative in all cases. The independent variable, income, now part of the specification, was insignificant in all functional forms for both visits which were part of an annual vacation and those which were not.

The third specification of the demand function included price, income and urbanization as the explanatory variables (see Table IV-3). The linear functional form of this specification resulted in estimated values of coefficients such that price was significant at the 1 percent level, and both income and urbanization were insignificant for both vacation and non-vacation use. In this case the coefficients on all explanatory variables were negative for visits which were part of an annual vacation; the respective coefficients were negative for price and urbanization, and positive for income where visits were not part of an annual vacation.

For the exponential functional form (see equations 2A and 2B in Table IV-3), income was insignificant in both vacation and non-vacation use; urbanization was insignificant in explaining vacation use and significant only at the 10 percent level (with a negative coefficient) in explaining non-vacation use. The price variable was significant at the 1 percent level and the sign of

the relevant price coefficient was negative for both vacation and non-vacation use.

In the double logarithmic form of the function specified as visits per thousand population being dependent upon price, income, and urbanization, the value of $\bar{R}^2$ for vacation use was approximately 0.49 (equation 3A, Table IV-3), and for non-vacation use was approximately 0.58 (equation 3B, Table IV-3). The demand curves for the entire recreational experience are downward sloping for both visits which were part of an annual vacation and those which were not. Both demand curves are asymptotic to both axes, therefore, no matter how high the cost, the visit rate will never fall to zero, while as cost approaches zero, the visit rate will rise towards infinity. The price elasticity of demand, indicated by the estimated coefficient on the price variable, is greater when visits are not part of an annual vacation. For both demand curves the constant price elasticity of demand exceeds unity indicating that for a given unit price increase, the change in quantity demanded would be sufficient to decrease total revenue in a normal market situation. For visitors who are not on an annual vacation, the subsequent decrease in quantity demanded would be greater relative to those visitors for whom the visit is part of an annual vacation. The positive coefficient on the income variable indicates that according to this specification, the income elasticity of demand associated with outdoor recreation is less than unity, but not negative (see equations 3A and 3B in Table IV-3). However,

the lack of significance in the relationship between visits per thousand population and income, for both vacation and non-vacation use, indicates that changes in visitation rates cannot be accounted for by changes in income.

The negative relationship between visits per thousand population and the populations of the centres of origin was an unexpected result. This negates the general empirically based assumption that as the level of urbanization increases, so too does the demand for recreation. To reiterate, this is a case study of only one type of outdoor recreational facility among many. It may be the character of the facilities and activities offered at the Clearwater-Rocky Forest that they do not attract the residents of larger, more urbanized centres.

Finally, the major and most important implication, in consideration of benefit estimation, of the estimation of the demand for the entire recreational experience is that it is now possible to establish the demand schedule for the recreational site itself. This will be the subject of Chapter V of this study.

CHAPTER V

Recreation Benefits Associated with the Clearwater-Rocky Forest

Introduction

In this chapter, the Hotelling-Clawson technique is utilized to estimate the demand curve for the recreational amenities of the Clearwater-Rocky Forest and the area under this "second-stage" or "final" demand curve is approximated to estimate the extra-market benefits associated with recreational use of the forest. The demand curve for the site itself indicates the amount recreationists would be willing to pay, over and above travel costs, for access to the recreational area in question. Consequently, the area under this final demand curve is equal to the consumers' surplus -- the amount recreationists would have been willing to pay but were not required to pay for the recreational use of the Clearwater-Rocky Forest. Alternatively, the area under the final demand curve is the amount a discriminating monopolist could potentially charge to the users of the facility.

Recreation Demand for the Clearwater-Rocky Forest

Using the information provided by the estimation of the demand for the entire recreational experience (the Hotelling-

Clawson initial demand curve which was estimated in the preceding chapter), the demand for the recreational amenities associated with the Clearwater-Rocky Forest was established. Again, two separate relationships were estimated -- one where visits to the Clearwater-Rocky Forest were part of an annual vacation, and one where they were not.

From among the functional forms and specifications of the demand for the entire recreational experience outlined in Chapter IV, equations 3A and 3B in Table IV-3 were chosen to estimate the vacation and non-vacation demand respectively for the recreational site. In both these equations the value of $\bar{R}^2$ was relatively high indicating some degree of predictability with respect to the value of the dependent variable. With respect to this functional form, both the price level and population were significant in explaining the quantity demanded. For both equations 3A and 3B, the value of the F-statistic was statistically significant.

The resulting demand schedules for vacation and non-vacation use are indicated in Tables V-1 and V-2 respectively. As noted previously, this particular functional form of the relationship (logarithmic in both dependent and independent variables) results in an estimated relationship which is asymptotic to both axes. This eliminates the possibility of estimating a final demand curve where both the dependent and independent variables are, at some point, equal to zero. In this practical application, to facilitate the estimation of the area under the demand curve, a price level of zero

TABLE V-1

DEMAND SCHEDULE FOR THE CLEARWATER-ROCKY FOREST WHERE VISITS ARE PART OF AN ANNUAL VACATION

Price (Dollars)	Quantity (Visits)
0	4194
5	1711
10	1324
15	1057
20	893
25	760
30	658
35	579
40	510
45	488
50	416
55	380
105	180
155	100
205	64
255	47
305	36
405	24
505	16
1000	6
1500	4
2000	2

TABLE V-2

DEMAND SCHEDULE FOR THE CLEARWATER-ROCKY FOREST WHERE VISITS ARE NOT PART OF AN ANNUAL VACATION

Price (Dollars)	Quantity (Visits)
0	4016
5	1623
10	1155
15	887
20	700
25	580
30	482
35	415
40	357
45	311
50	275
55	238
105	97
155	43
205	27
255	20
305	12
405	7
505	5
605	4
705	2
805	2
905	1

was imparted to the analysis. The quantity of visits demanded at zero price was taken to be the total number of visits observed from the various centres of origin included in the analytical framework. Also implicit in this functional form is the fact that, no matter how high the price level, the quantity of visits demanded will never be equal to zero. Again for purposes of practical application, the relationship was estimated only to the point where the quantity of visits from each centre of origin was equal to one.

Accordingly, the quantity demanded of visits which were part of an annual vacation at a price level of zero was equal to 4194. When a hypothetical fee of $5.00 was added to the travel cost of vacationing users, the quantity demanded fell sharply to 1711 visits. Beyond the fee of $5.00, and for equally spaced increases in the toll, the decrease in quantity demanded diminishes. Beyond a fee of $505.00 the quantity of visits demanded stems from Calgary and Edmonton only. Since these are the two most heavily populated centres, a higher fee is required to reduce visits from them to a level of one. Less densely populated centres such as Provost and Morinville are reduced to one visit at a much lower price ($55.00 for Morinville and $50.00 for Provost).

The quantity demanded of visits which were not part of an annual vacation at a price level of zero was equal to 4016. Once more, as in the case where the visit was part of an annual vacation, when a hypothetical fee of $5.00 was introduced, the quantity

demanded fell sharply to 1623 visits. Again, beyond the fee of $5.00, and for equally spaced increases in the fee, the decrease in quantity demanded diminishes. In the case of non-vacation use, Edmonton and Calgary become the only influences on quantity demanded at a price of $255.00. Where visits are not part of an annual vacation, visits from Calgary and Edmonton are reduced to one at a price level of $905.00. Less densely populated centres such as Provost and Morinville again are reduced to one visit at a much lower price ($20.00 for Morinville and $25.00 for Provost).

At each price level the quantity demanded is greater where visits are part of an annual vacation. This is not an unexpected result since the payment of such a toll or fee would represent a lesser percentage of total expenditures to those who are visiting the Clearwater-Rocky Forest as part of an annual vacation. Non-vacation visitors, on the other hand, would be less tolerant of the fee since it represents a greater percentage increase in their expenses.

Benefits Estimated in Terms of Consumer Surplus

The area under the demand curve for the recreational site itself was estimated by computation of the area of a series of rectangles. Starting from a price level of zero, the height of each rectangle was taken as the mid-point between two consecutive prices. The base of the rectangle was measured as the associated change in quantity demanded between the corresponding consecutive

price levels. Using this technique the consumers' surplus for the users of the facility for whom the visit was part of an annual vacation was estimated to be $93,810.00. The consumers' surplus for the users who were not on annual vacation amounted to $61,904.00. Together, these two values total $155,714.00, which is the estimated consumers' surplus for recreational users of the facility in the summer of 1972.

The consumers' surplus so calculated indicates the sum of primary benefits accruing to the recreational users included in the analysis, and generated by the Clearwater-Rocky Forest in 1972, between May 20th and September 4th. This time period is the temporal basis for the benefits estimated.

The resulting value of benefits derived is a considerable underestimation due to the rotating nature of the interviews, as previously outlined, and also due to the fact that not all recreational users from Alberta were included in the analysis. To facilitate practical application, only visitors from centres of origin with population greater than one thousand were included in the analytical framework. A further downward bias is introduced to the estimation of benefits by the exclusion of time as a cost in the derivation of the first stage demand curve.

If the visits which were included in the analysis are regarded as a 54.3 percent sample of the total recreational visits recorded by the Clearwater-Rocky User Survey and if the 3409 recreational interviews are taken as 26.5 percent of the potential,

due to the rotation of the interviews, it may be said that the benefits valued above represent approximately 14.4 percent of those generated by the Clearwater-Rocky Forest between May 20th and September 4th, 1972. The figure of $155,714.00 may then be adjusted accordingly to yield an estimate of the total value of the Clearwater-Rocky Forest in recreational use in the summer months of 1972. This estimate is $1,081,347.00.

It is also instructive to calculate the benefits generated on a visitor-day basis. This calculation eliminates the temporal restriction involved, in that visitor-days at times of the year other than the period between May 20th and September 4th may be added, yielding an estimate of benefits on a yearly basis.

Distribution of the total consumers' surplus among the total number of visits observed for each of vacation and non-vacation use yields a value of $22.37 and $15.41 per visit respectively for each. Since these values are on a per party or per vehicle basis, it is necessary to correct this value according to the average number of persons in each party or vehicle. The assumption of an average of 4.4 persons per vehicle yields an estimate of $5.08 and $3.50 for vacation and non-vacation use respectively. This is the amount that each visitor is willing to pay, over and above travel costs, for access to the recreational facilities of the Clearwater-Rocky Forest.

To compute the value on a visitor-day basis it is necessary to further correct the value estimated above according to

the number of days each visitor spent in the forest. For vacation users, the average number of days spent in the forest was 1.06 days; for non-vacation users, this figure was 1.01 days. This yields a value of $4.79 per visitor-day for vacation use and $3.46 per visitor-day for non-vacation use of the recreational facilities located in the Clearwater-Rocky Forest. The higher value placed on a visitor-day related to vacation use indicates that, in fact, since the Clearwater-Rocky Forest is not the sole purpose of the trip for vacation users, they appear to be willing to pay more for access to the area than their non-vacationing counterparts.

Summary

Using the Hotelling-Clawson technique of estimating the demand curve for the recreational facilities of the Clearwater-Rocky Forest, and the consumers' surplus approach to the estimation of value, the benefits associated with the recreational use of this area have been evaluated. The extra-market benefits generated in the recreational use of the Clearwater-Rocky Forest in the summer months of 1972 were estimated to be approximately $1,081,347.00. The value per visitor-day for vacation use was estimated at $4.79 and for non-vacation use at $3.46.

CHAPTER VI

Conclusion

This thesis was an examination of the potential applicability of the Hotelling-Clawson technique in valuing non-priced recreational resources by means of an indirect estimation of the demand for part of the Alberta forest resource. Application of this technique and of the consumers' surplus approach to the estimation of value, yielded an estimate of the extra-market benefits associated with the recreational use of the Clearwater-Rocky Forest.

Three reports on the forest resource in Alberta were examined in Chapter II of the study. Necessary concepts and considerations for the study of natural resource use were introduced and their presence or absence in each of the three reports was indicated. It was established that the E.P.E.C. report, in an attempt to estimate the recreational demand for the forest resource, had, in fact, by use of a methodologically weak technique of benefit estimation known as the gross expenditure method, estimated the magnitude of the recreational industry. Such measures are not an estimate of recreation demand. Evaluation of extra-market benefits associated with the recreational use of a resource requires the estimation of a price-quantity relationship.

In Chapter III of the study the various methods derived for the estimation of this price-quantity relationship were examined. Together with some less acceptable techniques, three of the more tenable methods of estimating the demand for non-priced recreational resources were examined in some detail. The methodology, assumptions, and limitations of each were determined, with particular emphasis being placed on the Direct Method, the Pearse Method and the Hotelling-Clawson Method. It was also pointed out that, given an estimated statistical demand curve for a non-priced recreational resource, there exist essentially two techniques which may be applied to place a value on that recreational resource. They are the monopoly revenue approach and the consumer surplus or discriminating monopoly revenue approach.

In Chapter IV the demand for the entire recreational experience associated with the use of the Clearwater-Rocky Forest was estimated. For both vacation and non-vacation use a double logarithmic functional form of the relationship specified such that visits per thousand population was dependent upon travel cost, average income, and the population of the centre of origin gave a relatively high value of $\bar{R}^2$. For these equations the value of the F-statistic was statistically significant. With respect to this specification and functional form, both the price level and population were significant in explaining the quantity demanded. The first-stage demand curve was found to be downward sloping, with visits per thousand population positively related

to average income level and negatively related to the population of the centre of origin.

Chapter V of the study included the estimation of the demand curve for the recreational facilities of the Clearwater-Rocky Forest (the Hotelling-Clawson second-stage demand curve) and the subsequent estimation of the value of these facilities to each visitor. For visitors who were not on annual vacation, the value each placed on the amenities of the Clearwater-Rocky Forest was estimated to be $3.46 per day. The equivalent value for visitors who were on annual vacation was $4.79 per day. For all visitors who were included in the analysis the total consumers' surplus was estimated to be $155,714.00. It was noted that those visitors included in the analytical framework represented an estimated 14.4 percent sample of all recreational users of the Clearwater-Rocky Forest in the summer of 1972. The estimated value of consumers' surplus was subsequently adjusted to include those visitors not included in the analysis. The result was an estimate, possibly a rather crude estimate, of the value of the Clearwater-Rocky Forest in recreational use between May 20th and September 4th, 1972. This value was $1,081,347.00.

The purpose of this study was to indicate the potential applicability of one of the techniques, namely the Hotelling-Clawson Method, which estimate consumers' willingness to pay for a non-priced recreational resource. As stated previously, this technique was chosen on the basis of data availability, not on

the basis of theoretical superiority over other approaches involving an estimate of willingness to pay. Future empirical studies of this nature should include a comparison of results using other techniques which also evaluate consumers' willingness to pay.

It was also stated that the estimates derived in this study could be applied only to the value of the Clearwater-Rocky Forest in recreational use. Additional studies of this type are required to establish the value of other recreational opportunities.

The results of this research may be taken as an indication of the value, in recreational use, of this part of the Alberta forest resource and may provide some insight into the implications of future forest land allocation.

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APPENDIX A

1972 CLEARWATER-ROCKY USER SURVEY

QUESTIONNAIRE

ALBERTA GOVERNMENT OUTDOOR RECREATION SURVEY

Exit surveyed

Date

Day

Time

Vehicle registration

Vehicle type

Number in vehicle

Where did journey begin?

Where will journey end?

Where did this trip begin today?

Where will this trip end today?

Trip purpose

Entrance used

What is the main purpose of this recreational visit?

- private recreational use
- institutional group recreational use

Did your group use any of the following during this visit?

- tent
- tent trailer
- travel trailer
- truck camper or camper coach
- motel or other rental accommodation
- cottage
- private home
- canoe
- boat
- horse (rented within forest)
- horse (brought into forest)
- restaurant, cafe or concession
- trail bike
- off highway vehicle

For your group, is this:

- a one-day outing
- a visit of one or more nights?

How long did you stay in the forest this visit?

- number of hours (if not overnight)
- number of nights.

Is this visit part of your annual vacation?

Activities

- driving, sightseeing
- camping
- picnicking
- walking - hiking
- mountain climbing
- fishing
- swimming
- pleasure boating
- water skiing
- horse riding
- hunting
- trail biking
- off highway vehicle use
- others

If there were to be further development in this forest, which of the following would you like developed?

- picnic areas
- playground
- directional signs
- better roads
- more roads
- campgrounds
- primitive camping areas accessible only on foot
- nature interpretation trails
- hiking trails
- natural swimming area
- boat launch
- trail ride concession
- concessions and services
- leave "as is"
- other

What is the occupation of the head of the household?

Which of the answers below best describes the level of education completed by the head of your household?

- grade school
- part high school
- high school graduate
- part university
- university graduate
- technical-vocational school

Which of the answers below best describes the total annual income of your household?

- under $3,000
- $3,000 - $5,999
- $6,000 - $7,999
- $8,000 - $9,999
- $10,000 - $14,999
- over $15,000

How many people are supported by this income?

APPENDIX B

TRAVEL COST, AVERAGE INCOME, POPULATION, AND VISITS PER THOUSAND POPULATION BY CENTRES OF ORIGIN

WHERE VISITS ARE PART OF AN ANNUAL VACATION

Centre of Origin	Travel Cost (dollars)	Average Income (dollars)	Population of Centre	Visits per Thousand Population
Banff	21.11	4,377	2,800	9.6
Barrhead	41.00	3,025	2,700	2.2
Calgary	17.65	4,475	398,000	2.6
Camrose	24.05	3,303	8,900	7.2
Canmore	18.86	3,860	1,600	1.3
Castor	28.72	3,197	1,100	1.8
Cochrane	13.84	3,861	1,000	7.0
Cold Lake	60.38	3,675	1,200	5.0
Devon	26.82	4,137	1,400	5.0
Didsbury	15.57	3,517	1,800	8.9
Drayton Valley	23.70	4,202	3,700	12.7
Drumheller	17.82	3,340	5,200	2.5
Edmonton	26.30	5,103	435,500	4.2
Edson	19.72	3,985	4,000	13.8
Fort Macleod	34.25	3,675	2,700	1.5
Fort Saskatchewan	31.14	4,150	5,700	2.3
Grande Cache	25.78	4,486	2,400	1.3
Grande Prairie	42.90	3,808	12,000	.2
Hinton	10.38	4,283	4,600	10.2

Centre of Origin	Travel Cost (dollars)	Average Income (dollars)	Population of Centre	Visits per Thousand Population
Innisfail	10.55	3,446	2,400	59.6
Jasper	18.68	4,295	2,500	2.8
Lac La Biche	50.34	3,475	1,700	1.1
Lacombe	13.67	3,665	3,200	16.5
Leduc	24.05	4,237	4,000	5.0
Lethbridge	39.44	3,908	40,800	0.2
Medicine Hat	47.75	5,311	25,700	0.5
Medley	58.99	4,075	7,500	0.6
Morinville	33.74	3,141	1,200	10.8
Olds	13.67	3,786	3,400	12.0
Peace River	71.10	4,283	5,300	1.9
Ponoka	17.47	3,475	4,500	10.4
Provost	48.96	3,175	1,500	1.3
Red Deer	11.42	3,872	27,400	7.8
Rimbey	12.46	3,089	1,400	10.0
Rocky Mountain House	3.11	3,721	3,100	47.0
Sherwood Park	27.68	5,070	14,200	3.1
Slave Lake	52.59	4,069	2,000	1.0
Spirit River	74.91	4,184	1,100	5.4
St. Albert	27.85	2,757	11,200	1.1
St. Paul	46.19	3,065	4,200	0.9

Centre of Origin	Travel Cost (dollars)	Average Income (dollars)	Population of Centre	Visits per Thousand Population
Stettler	21.80	3,583	4,200	3.3
Stony Plain	30.97	4,395	1,600	2.5
Strathmore	21.80	3,664	1,200	1.6
Swan Hills	49.48	5,210	1,400	6.4
Sylvan Lake	9.34	3,162	1,400	25.7
Taber	44.63	5,487	4,600	0.6
Three Hills	11.42	2,691	1,400	10.7
Wainwright	38.75	3,269	3,700	5.4
Westlock	34.95	3,601	3,300	1.8
Wetaskiwin	19.90	3,459	6,500	13.1
Whitecourt	37.89	4,657	3,100	0.6
Vermilion	45.50	3,407	2,900	3.1

WHERE VISITS ARE NOT PART OF AN ANNUAL VACATION

Centre of Origin	Travel Cost (dollars)	Average Income (dollars)	Population of Centre	Visits per Thousand Population
Athabasca	41.69	3,348	1,800	0.5
Barrhead	41.0	3,025	2,700	2.6
Blairmore	37.20	3,790	1,800	1.1
Bonnyville	54.15	3,026	2,500	4.4
Calgary	17.65	4,475	398,000	1.1
Camrose	24.05	3,303	8,900	1.9
Claresholm	30.10	2,964	3,300	1.2
Coaldale	40.48	3,026	2,700	0.7
Cochrane	13.84	3,861	1,000	16.0
Cold Lake	60.38	3,675	1,200	5.0
Coleman	36.68	3,754	1,400	2.9
Devon	26.82	4,137	1,400	3.6
Didsbury	15.57	3,517	1,800	7.7
Drayton Valley	27.70	4,202	3,700	7.3
Drumheller	17.82	3,340	5,200	2.7
Edmonton	26.30	5,103	435,500	2.0
Edson	19.72	3,985	4,000	3.3
Fort MacMurray	73.70	4,750	6,600	1.5
Fort Saskatchewan	31.14	4,150	5,700	3.0

Centre of Origin	Travel Cost (dollars)	Average Income (dollars)	Population of Centre	Visits per Thousand Population
Grande Cache	25.78	4,486	2,400	3.3
Grande Centre	58.99	3,963	2,200	1.8
Grande Prairie	42.90	3,808	12,000	2.0
Grimshaw	75.08	3,517	1,700	3.5
Hinton	10.38	4,283	4,600	1.5
Innisfail	10.55	3,446	2,400	11.6
Lacombe	13.67	3,665	3,200	36.8
Leduc	24.05	4,237	4,000	8.5
Lethbridge	39.44	3,908	40,800	0.4
Medicine Hat	47.75	5,311	25,700	0.3
Morinville	33.74	3,141	1,200	0.2
Olds	13.67	3,786	3,400	17.1
Peace River	71.10	4,283	5,300	0.8
Ponoka	17.47	3,475	4,500	18.4
Provost	48.96	3,175	1,500	0.7
Red Deer	11.42	3,872	27,400	37.5
Rimbey	12.46	3,089	1,400	26.4
Rocky Mountain House	3.11	3,721	3,100	237.4
St. Albert	27.85	2,757	11,200	3.0
St. Paul	46.19	3,065	4,200	0.9
Sherwood Park	27.68	5,070	14,200	2.6

Centre of Origin	Travel Cost (dollars)	Average Income (dollars)	Population of Centre	Visits per Thousand Population
Spruce Grove	29.93	4,395	2,700	5.5
Stettler	21.80	3,583	4,200	9.7
Stony Plain	30.97	4,395	1,600	3.1
Strathmore	21.80	3,664	1,200	10.0
Sylvan Lake	9.34	3,162	1,400	85.7
Three Hills	11.42	2,691	1,400	12.8
Two Hills	39.62	3,169	1,100	3.6
Vegreville	35.98	3,011	3,700	1.3
Vermilion	45.50	3,407	2,900	1.4
Vulcan	30.97	3,332	1,600	1.2
Wainwright	38.75	3,269	3,700	1.1
Wetaskiwin	19.90	3,459	6,500	3.5
Westlock	34.95	3,601	3,300	1.5
Whitecourt	37.89	4,657	3,100	2.3